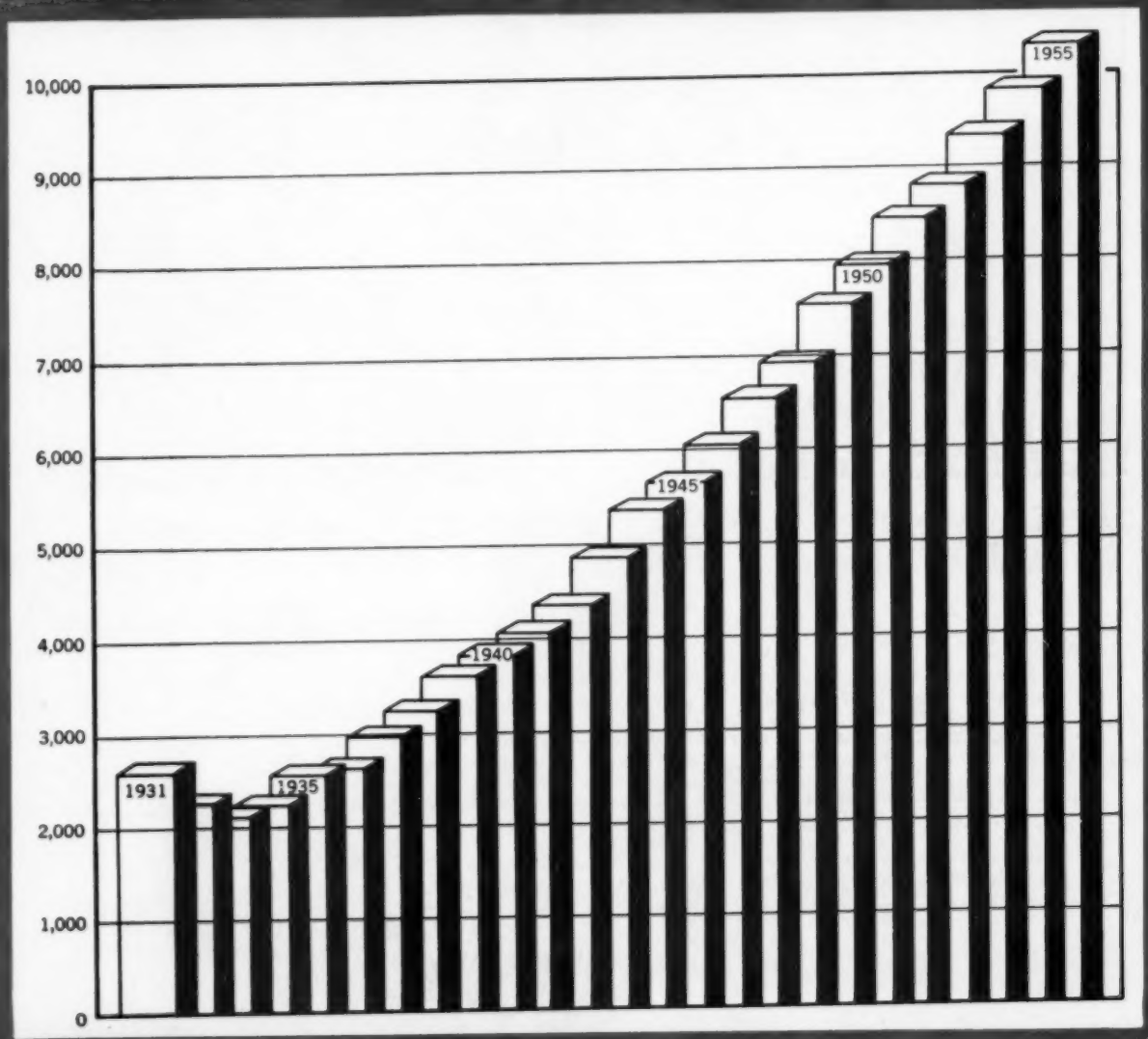
WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL



MAY 1956

A.W.W.A. got a vitamin tablet . . . formula "HEJ"
(See A.W.W.A's "Stairway to the Stars" . . page 238)

Cutting Large Diameter Cast-Iron Pipe
Bentonite Clay as a Coagulant Aid at Gary

NO MATTER HOW YOU FIGURE IT...

When you undertake the purchase of a new pipeline for your water supply system, do you figure from the financial angle—low first cost, economical installation and a long life for your investment?

Or are you more interested in the construction of the line—minimum excavation, easy assembly, and watertight joints in a pipe strong enough to withstand high pressures and heavy external loads?

Then, again, your specialty may be maintenance. In that case you probably figure minimum repairs through freedom from breaks and leaks to be of paramount importance.

Or is your main concern with operation? If so, you no doubt figure permanent high carrying capacity, low pumping costs and trouble-free service to be vital.

Still, *no matter how you figure it*, your best answer will always be LOCK JOINT CONCRETE PRESSURE PIPE, because it most nearly approximates the ideal pressure pipe for water works systems.

LOCK JOINT PIPE CO.

East Orange, New Jersey

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Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

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Simple...Foolproof...Low Cost

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Model 35A115
Homelite Generator
1500 Watts, 115 Volt
60 Cycle AC

WEIGHS ONLY 90 LBS.

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2. Constant Voltage . . . less than 4% change from no load to full 1500 watt capacity . . . assures long service life for your electric tools . . . guarantees top performance at all times.

3. Overload Capacity . . . 1500 watt continuous duty with generous overload capacity prevents tool stalling under heavy loads . . . insures uninterrupted service even when starting loads exceed operating loads.

4. Compact and Lightweight . . . one man can easily carry this 90 lb. generator wherever you need electricity to power time-saving electric tools. No need for long, hazardous power-consuming cables.

Whatever tools you want to operate—electric saws, drills, floodlights, grinders, belt sanders, hammers,—the new Homelite 35A115 generator can save you money. For a free demonstration or additional information, call your nearest Homelite representative, or write:

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Ask your Homelite representative to show you how this easily-installed accessory reduces engine wear . . . increases service life . . . cuts fuel consumption.

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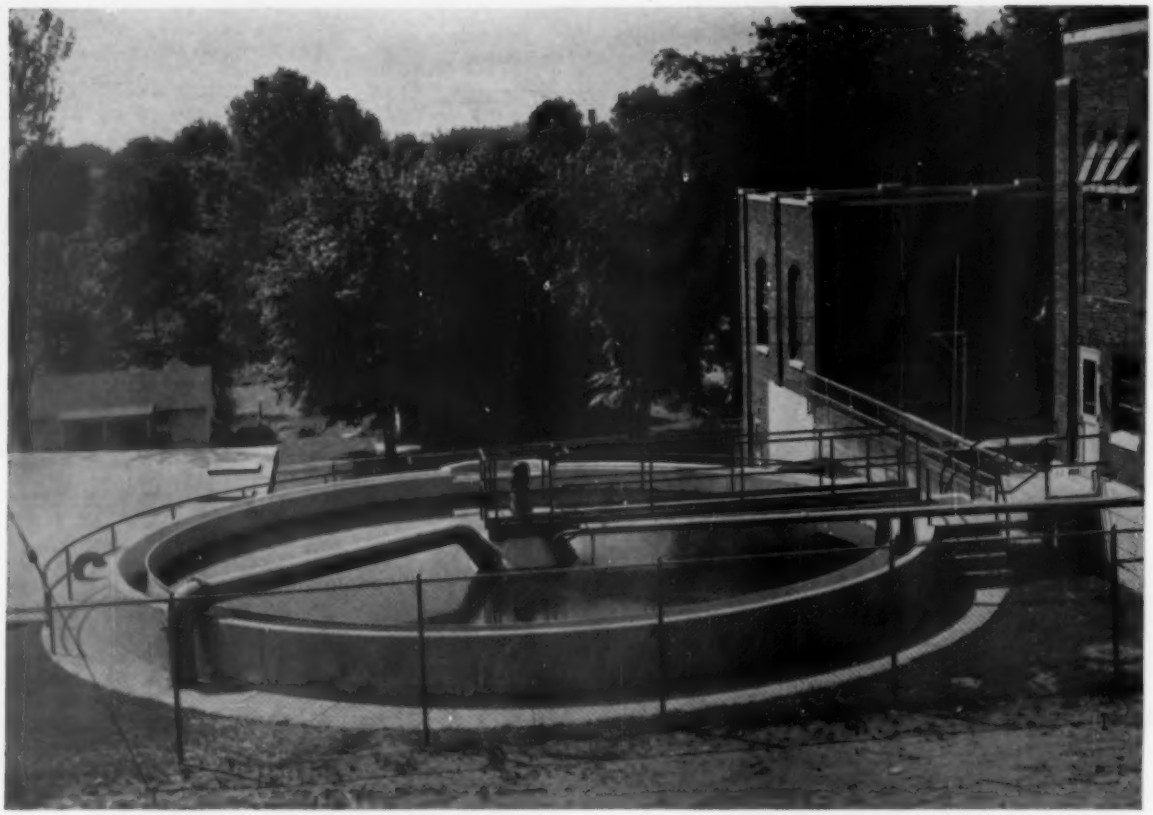
Manufacturers of Carryable PUMPS • GENERATORS • BLOWERS • CHAIN SAWS



RAPID CLARIFICATION: Storms can increase Wabash River turbidity from 50 to 1500 ppm in as little as six hours! No matter how much or how fast turbidity changes, this Permutit Precipitator cuts it to less than 5 ppm in one fast step!

Clear water for Mount Carmel despite rapid turbidity jumps of 50 to 1500 ppm in 6 hours!

GROWTH OF POPULATION and increasing settling-basin odors from sewage and oil-field wastes persuaded Mount Carmel officials to look for a more efficient water-treatment plant. The new plant would have to deliver twice as much water . . . eliminate bad odors . . . handle spurts of *high* turbidity.

HOW IT'S DONE: A suspended sludge-blanket type of equipment was indicated, and a Permutit Precipitator was installed. Now they get 2½ mgpd of clear water *in half the time* it took two old settling basins to treat only 1½ mgpd! All with *no increase in manpower.* There are no more bad odors during treatment. Chemical costs are lower.

FILTER SAVINGS: Added to the existing three filters . . . two new filters with Permutit Monocrete® Underdrain Systems that are non-corrodible, low in cost, easily built.

AUTOMATIC FEATURES: Mount Carmel's Precipitator has photoelectronic control. The unit is automatically blown down in direct proportion to the flow rate and the amount of total solids precipitated. Since the three existing filters had obsolete controls, five new gravity filter operating tables were installed to control backwashing and filtering automatically!

"Everything is running smoothly. We're getting a better grade of water . . . clearer water," reports Supt. Elmo Conrady.

"It's all automatic. Mud goes right back into the river . . . eliminating the cleaning of basins," reports Chief Operator Cedric Seaton.

"It has given excellent performance since operation began," report Warren & Van Praag, Inc., Consulting Engineers, Decatur, Illinois.

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WATER AND SEWAGE WORKS is published monthly with an extra issue in June. Subscriptions including the Reference and Data issue in the U.S. and Canada, 1 year $3.00; 2 years $4.50; 3 years $6.00. Other countries $1.50 per year additional. Single copies 25c except Reference and Data issue 50c.

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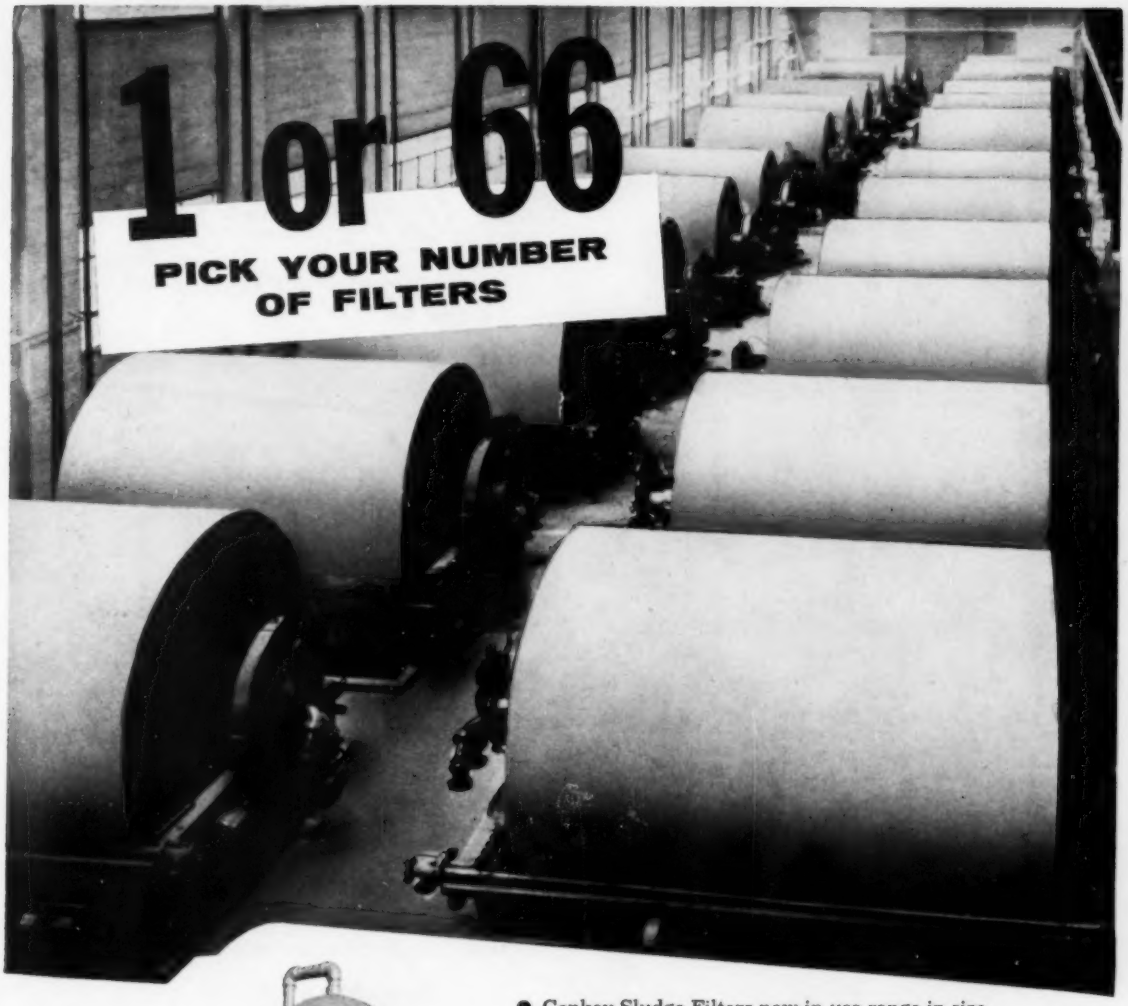

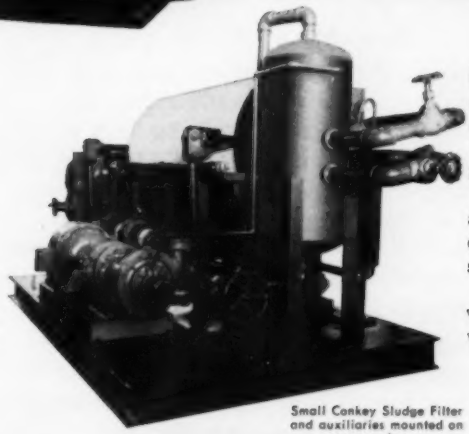

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WITH THE **RING-TITE** COUPLING

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it must be strong . . . tough . . . uniform . . . and durable.
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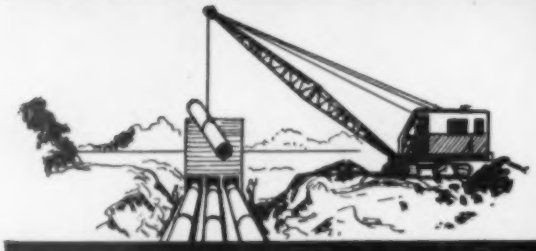
How Oklahoma City Solved a Sewer Relocation Problem –



AMERICAN Double-X
Mechanical Joint Pipe

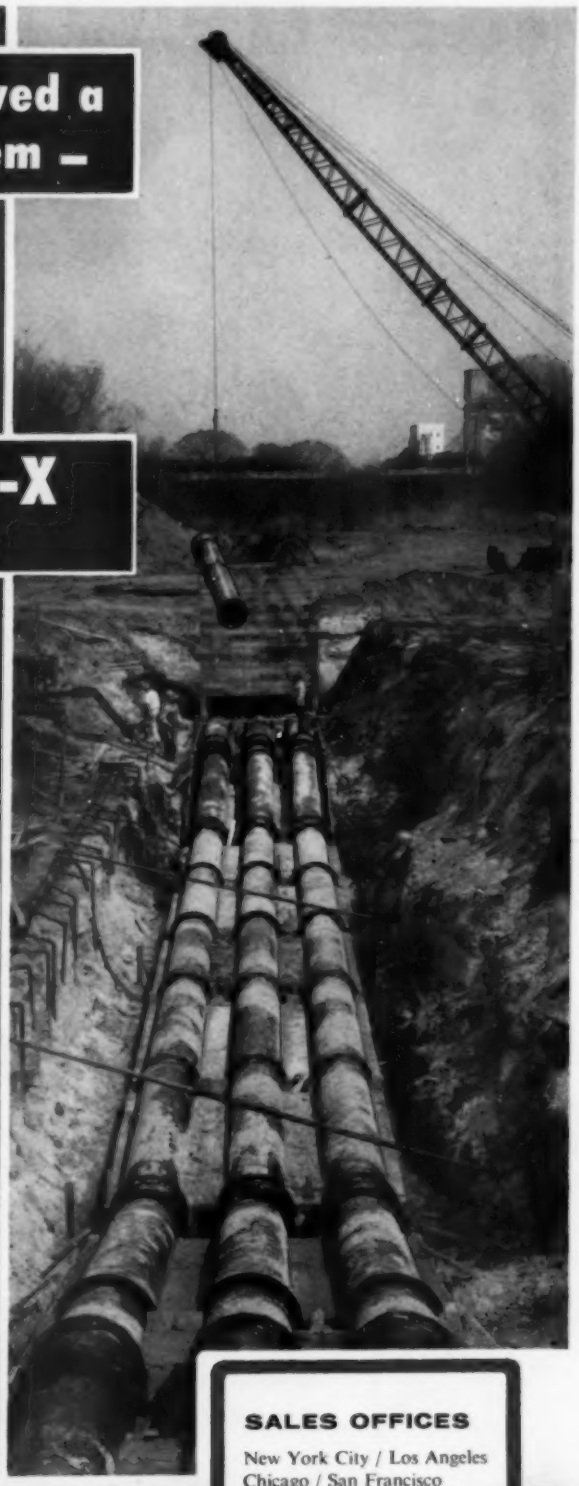
When the channel of the North Canadian River at Oklahoma City had to be relocated, Oklahoma City faced a sewage disposal problem. The sixty-inch gravity sewer across the river bottom obstructed the path of the new channel.

Engineering studies indicated that the installation of two inverted siphons with gravity flow was the most practical way to relocate the sewer.

Alert municipal officials in Oklahoma City planned for the future when these siphons were installed. With an anticipated future flow almost four times as great as the present maximum flow, three 30" American Double-X Mechanical Joint pipe lines were laid for one siphon, and three 24" Double-X lines for the second.

In addition to planning for adequate capacity, these officials planned for longer and more economical service. Corrosion-resistant, longer lasting cast iron pipe was their choice . . . *quality* pipe, centrifugally cast by the American Cast Iron Pipe Company.

If your project is important now, and will be even more important in the future, be sure you specify American Cast Iron Pipe.



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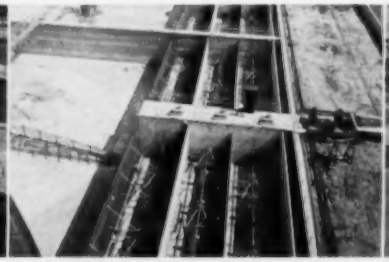
with LINK-BELT collectors . . . mixers . . . chemical handling system

TYPE SC CIRCULINE SLUDGE COLLECTORS, with pivoted rakes at ends of arms, adjust to collect sludge in corners of basin.



STRAIGHTLINE SLOW MIXERS are used in primary and secondary chambers. Detention time: 45 minutes at 48 mgd capacity.

LINK-BELT SCREW CONVEYORS AND BUCKET ELEVATORS distribute lime, sulphate and alum to tanks for live or reserve storage.

WATER from the Nueces River supplying Corpus Christi is hard and muddy. To provide ample water for the rapidly expanding population—which has doubled each decade since 1920—treatment facilities featuring Link-Belt equipment were installed at the new O. N. Stevens water filtration plant. A two-stage treatment provides rapid and thorough solids removal . . . effectively reduces the river's 142 ppm hardness.

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Let our engineers work with you, your chemists and consultants to assure top efficiency at all flow conditions. Call your nearest Link-Belt office for consultation with a sanitary engineering specialist.

14,124

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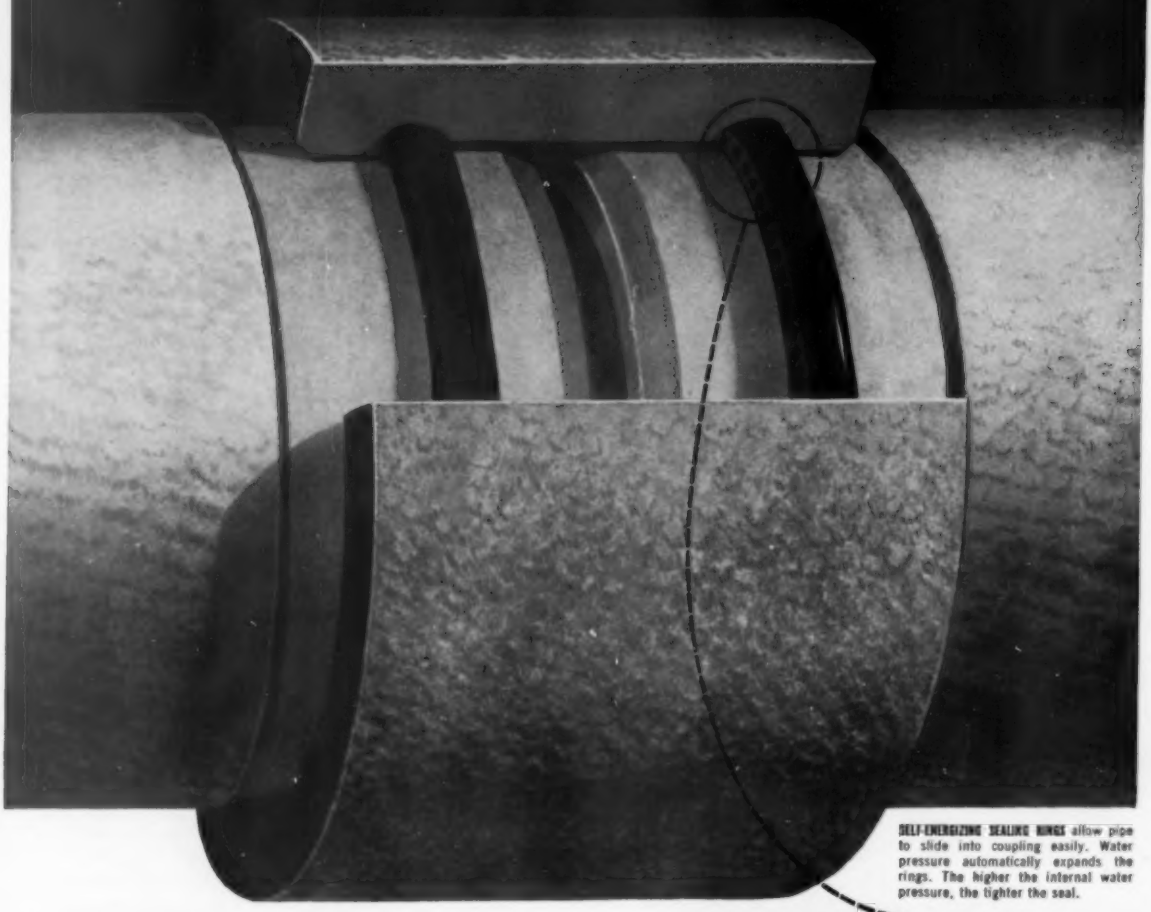

SELF-ENERGIZING SEALING RINGS allow pipe to slide into coupling easily. Water pressure automatically expands the rings. The higher the internal water pressure, the tighter the seal.

- **Cuts installation time**
- **Provides permanent, water-tight seal**

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"Century" Pipe and "Fluid-Tite" Couplings meet A.W.W.A., A.S.T.M., and Federal specifications and are approved by Underwriters' Laboratories, Inc.

New self-energizing "Fluid-Tite" sealing rings have tapered surfaces, and compress, to permit pipe to slide in easily.

When main is filled, rings expand with application of internal water pressure, creating a tighter seal.

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- ***More efficient use of aeration tank capacity***
- ***Lowered power requirements for air***

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WEST WARWICK, R. I.—The Kent County Water Authority is owner of this 1,000,000-gal welded-steel reservoir which was put into service in 1955. The tank measures 52 ft in height by 58 ft in diameter. General contractor for the job was General Engineering & Contracting Co.; engineer was Charles A. Maguire & Associates.

AKRON, O.—A Bethlehem erection crew completed this attractive, 1,500,000-gal standpipe during the summer of 1955. Standing 115 ft high by 47 ft in diameter, it has an elliptical self-supporting roof and is dressed up with an ornamental cornice. Engineering was by the Bureau of Water Supply, W. R. LaDuc, Chief Engineer and Superintendent.

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Welded steel tanks have many advantages for the storage of water above ground. They can be made permanently watertight; they are unaffected by climatic changes; they withstand damage due to shock, impact, explosion or surface settlement; they require little maintenance, and often cost less than competitive types of storage.

The Bethlehem organization is backed by nearly a half-century of experience in the design, fabrication and erection of storage tanks. Perhaps we could be of service to you. Please contact the Bethlehem sales office most convenient to you.

ROCHESTER, N. Y.—This 1,500,000-gal welded steel reservoir was built for the New York Water Service Corporation, which engineered the job. It is 40 ft high by 80 ft in diameter.

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The strongest pipe for water and sewage transmission. Leakproof. 40-ft lengths. Diameters 18 in. and up. For decades the preference of leading cities. May we give you more information?

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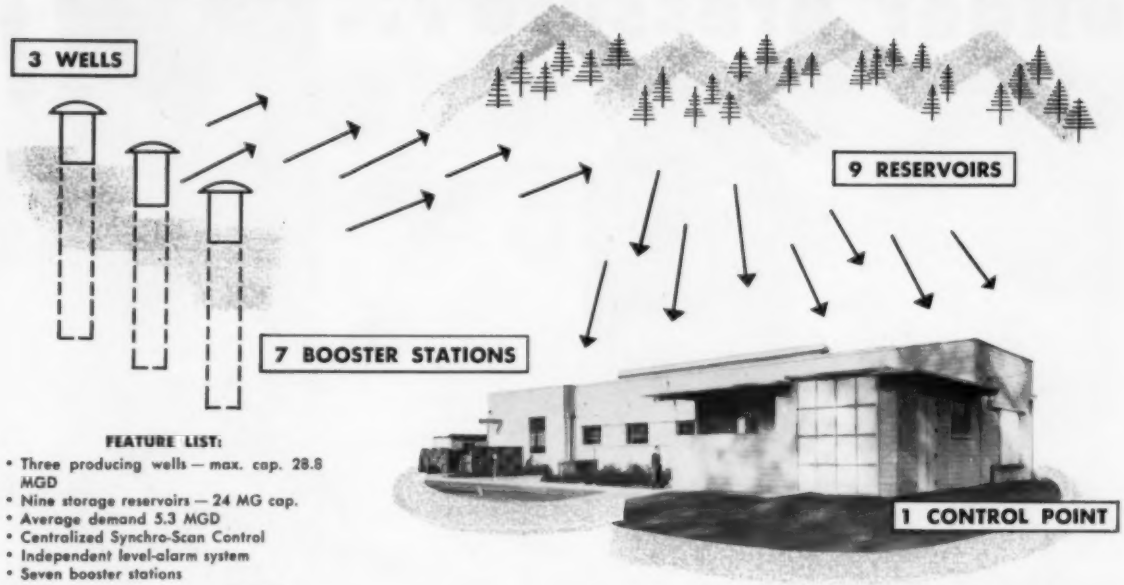

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- Average demand 5.3 MGD
- Centralized Synchro-Scan Control
- Independent level-alarm system
- Seven booster stations

Schematic Sketch — "Water-mation" in Whittier

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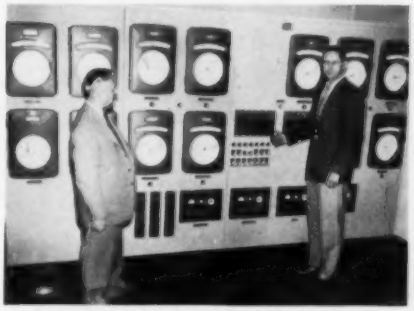

Master Control Panel — Whittier Pumping Plant

Close-up of "Plug-In" Component

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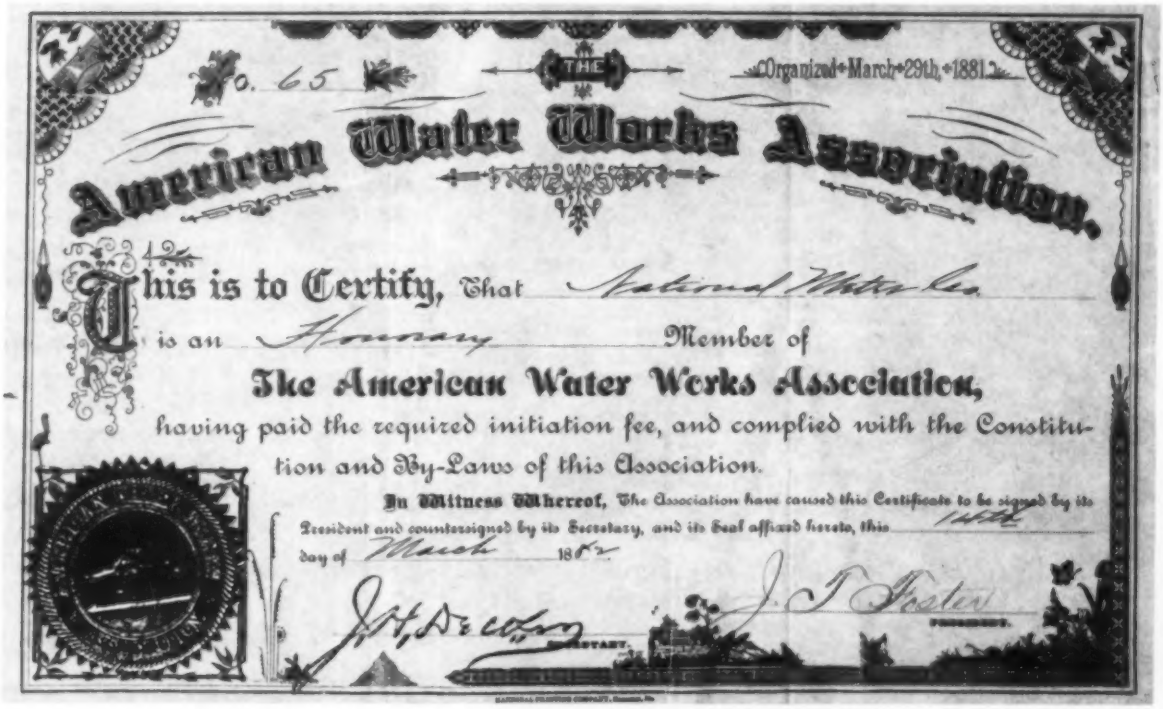
We've Worked and Grown Together

. . . and mighty proud to serve a great industry



No. 65

THE

Organized March 29th, 1881.

American Water Works Association.

This is to Certify, That National Meter Co.

is an Honorary Member of

The American Water Works Association,

having paid the required initiation fee, and complied with the Constitution and By-Laws of this Association.

In Witness Whereof, The Association have caused this Certificate to be signed by its President and countersigned by its Secretary, and its Seal affixed hereto, this 14th day of March 1882.

J. T. Foster PRESIDENT.

J. H. Dreer SECRETARY.

Replica of membership certificate awarded the National Meter Division of Rockwell away back in 1882. Pittsburgh Meter, another Rockwell company, joined the A.W.W.A. in 1898.

Rockwell people have always been closely identified with the A.W.W.A. since the first year of its inception. From long association we have learned there is no group more dedicated to public service than the A.W.W.A. membership. It is to their credit that the water and sewage disposal systems of this country have grown to become immensely valuable properties—vital to the needs of every community.

We at Rockwell salute the A.W.W.A. on this, the 75th anniversary of the Association and pledge our continued support and close cooperation.

W. F. ROCKWELL, JR., ***President*** *(center) says, "We consider it our obligation to keep the development of our products and the improvement of our services ahead of the day-to-day needs of the water utilities."*

L. A. DIXON, JR., Vice President, Meter and Valve Division (left) and J. F. O'GRADY, Water Products Manager, concur.

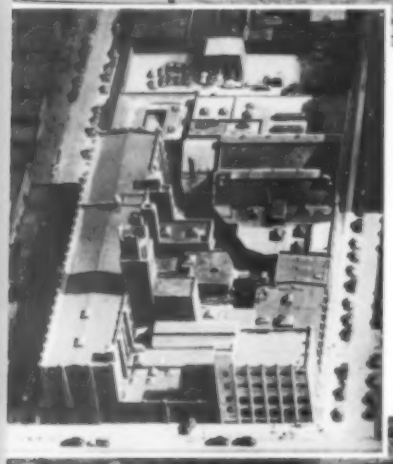
Rockwell Manufacturing Company

PITTSBURGH 8, PA.

dedicated to better service for you

Rockwell Increases Production • Intensifies

UNIONTOWN, PA. PLANT



BROOKLYN, N.Y. PLANT

PITTSBURGH, PA. PLANT

. . . better service for you

Rockwell water meters are now being made in three big plants located at Brooklyn, N.Y., Uniontown, Pa. and Pittsburgh, Pa. Service to West Coast water utilities will soon be materially benefited by the output from a large new factory now being erected in Porterville, California. And in Russellville, Ky., fabrication of raw materials has just started.

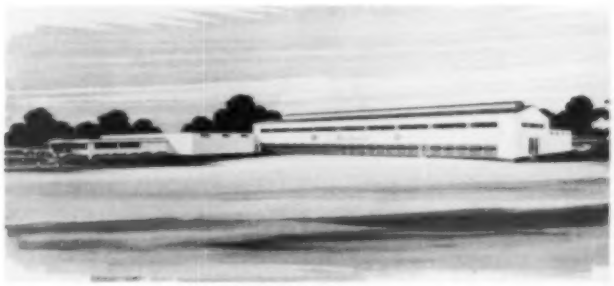
In the realm of research, extensive new Rockwell laboratories were recently opened. These are manned by a topnotch team of scientists. Rockwell facilities for product development are the finest—its staff by far the largest in the industry.

Personal service to customers has also been greatly enlarged. Nearly 200 trained and experienced men now represent Rockwell working out of 18 District Offices.

To the water works industry, all this means greater productive capacity, more new and improved products plus better service to those who buy and use Rockwell water meters.

NEW ROCKWELL PLANTS TO BE OPENED IN 1956

PORTERVILLE, CALIF.



RUSSELLVILLE, KY.

Research • Enlarges Sales Staff

P. C. KREUCH, ***Rockwell Vice President,*** says, "You can look to our staff of qualified territorial managers, and our large well-trained field force for real service to the industry."

Men Who Know Their Business

J. G. HOYT
Atlanta Dist. Mgr.

G. A. CUNNINGHAM
Charlotte Dist. Mgr.

F. C. ARENS
Boston Dist. Mgr.

R. A. JOHNSON
New York Dist. Mgr.

D. H. SHOEMAKER
Philadelphia Branch Mgr.

R. V. BURNETTE
Chicago Dist. Mgr.

T. O. CARSON
Pittsburgh Dist. Mgr.

E. D. PROPPS
Dallas Dist. Mgr.

T. I. STACY
Houston Dist. Mgr.

W. A. ADKINS
Midland Branch Mgr.

C. J. LANDRY
New Orleans Br. Mgr.

D. D. COLLINS
Shreveport Dist. Mgr.

ORVILLE COCHRAN
Denver Branch Mgr.

M. D. GILBERT
Kansas City Dist. Mgr.

H. M. LOGAN
Tulsa Dist. Mgr.

E. M. CLORAN
Los Angeles Dist. Mgr.

W. F. GULLEY
San Francisco Dist. Mgr.

R. E. NIMTZ
Seattle Dist. Mgr.

PLUS A FIELD FORCE OF NEARLY 200 TRAINED AND EXPERIENCED MEN TO SERVE YOU

. . . See important announcement, next page.

G. T. BOWMAN, *Products Manager, tells why*

The New Rockwell

Parts Packaging Program

. . . Means Better Service For You

Shipping room at a Rockwell parts depot.

Measuring chambers individually packaged.

Packaged parts stack neatly, save space.

Save Time—Space—Money

Most parts for Rockwell meters are now being neatly packaged in convenient quantities. Each package is clearly labeled. Complete parts for many sub-assemblies can also be obtained pre-sorted into easy-to-use packets.

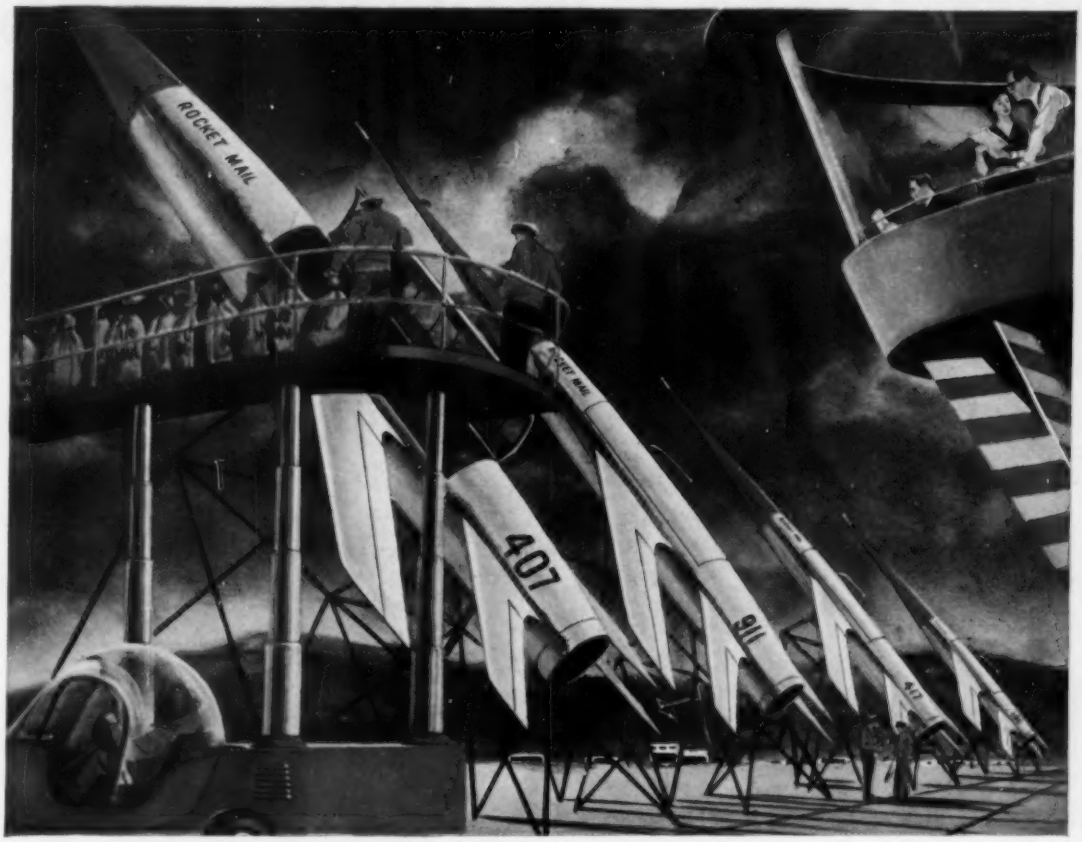
These compact, carefully designed packages prevent damage in shipment or deterioration in storage. They stack neatly on shelves—eliminate the need for bulky bins—simplify inventory control and re-ordering.

This packaging program saves you time, space and money. It's just another way Rockwell offers better service and better value to water utilities.

Rockwell Manufacturing Company

PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

Litho in U.S.A.



RADAR controlled and guided, high speed rockets streaking through the stratosphere may deliver New York mail to San Francisco in less than an hour!

100 years from now...

WE MAY SEND MAIL BY ROCKET!

A century from now a wonderful, exciting and different world. But there will be one familiar note. The cast iron pipe laid today will still be carrying water and gas to the homes and industries of tomorrow.

In over 60 American cities, these dependable cast iron water and gas mains, laid more than a century ago, are still serving efficiently. And modernized cast iron pipe, centrifugally cast, is even stronger, tougher, more durable.

U. S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE
CAST IRON

U. S. PIPE AND FOUNDRY COMPANY, General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE.

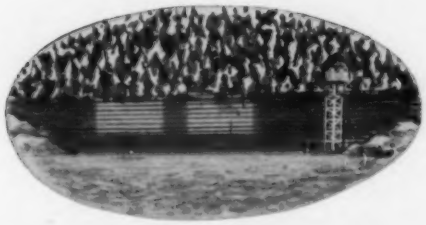
BIG TREES *From Little* ACORNS

From a small beginning some 35 years ago, M & H Valve and Fittings Company has steadily grown to become a foremost producer in the valve and hydrant industry. M & H products today are widely used for water distribution and fire protection services in all sections of the United States and many other parts of the world.

This M & H leadership is no accident. It is due to the cooperation of a loyal M & H organization, working with experience, skill and a great enthusiasm, to consistently design and produce valves and hydrants of recognized superiority. Catalog 52 sent upon request.

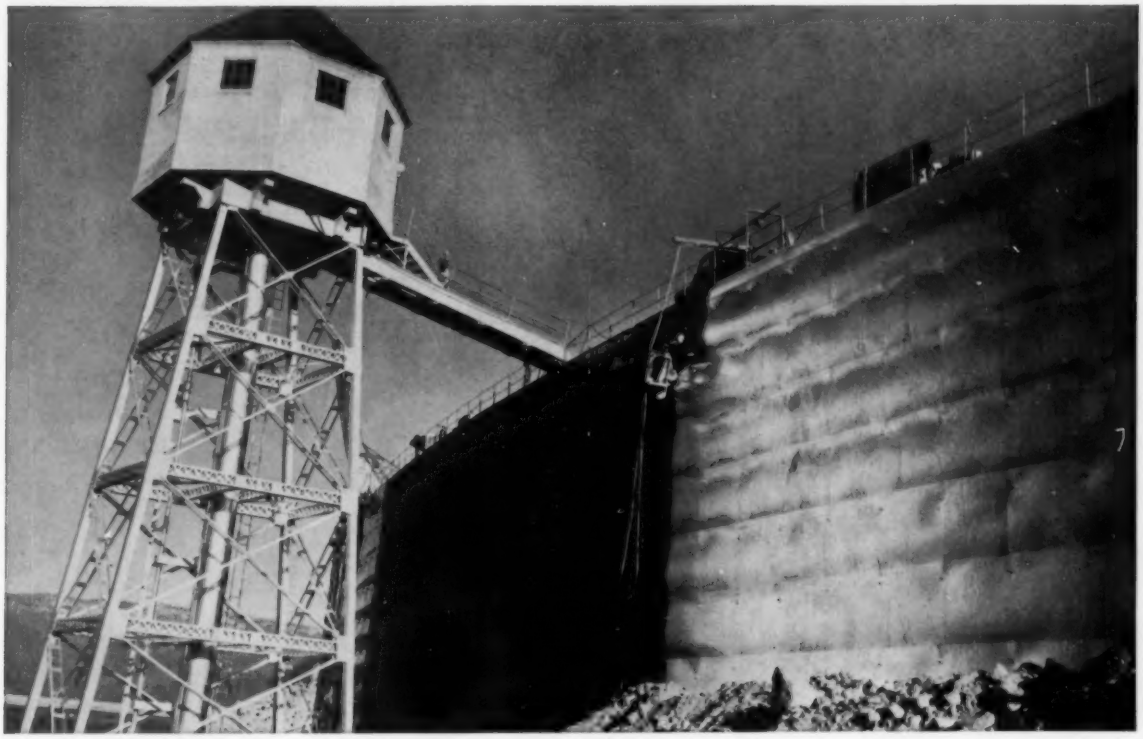
M&H VALVE AND FITTINGS COMPANY
Anniston, Alabama

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION



New TARSET®

selected for Maximum Protection of Big Dam Facing



THE Huntington Lake power dams in Central California have performed yeoman service since their construction in 1917. But 38 winters in the High Sierra is a long time . . . long enough for the annual freezing and thawing cycles to react on the concrete surfaces of the dams' faces. Southern California Edison Company therefore took important maintenance measures last summer.

To provide maximum protection against corrosion, welded steel plates—behind which was poured a six-inch minimum thickness of concrete—were installed on the upstream faces of the two dams. The steel plates were then sandblasted and given a protective coating of Pitt Chem "Tarset," the new coal tar-epoxy resin coating.

Tarset, the toughest, hardest coating of its kind ever developed from coal tar, is being called upon to solve all sorts of corrosion problems formerly classified as "impossible." Tests show that Pitt Chem Tarset can stop corrosion caused by atmospheric exposure . . . sour crude petroleum and petroleum products . . . salts and acids. And it actually becomes harder at temperatures as high as 400°F!

What can Tarset do for you? Outline your corrosion problem—either by phone or letter—and we'll gladly help you solve it.

Send for Descriptive Booklet on TARSET today

Free booklet tells how to use amazing new Tarset to reduce costly corrosion. Gives detailed description of Tarset's specifications, properties and application characteristics. Write for *your* copy today!

WSW 6064

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

Announcing

TWO GREAT EVENTS FOR MAY 17TH

THE CONSOLIDATION OF THREE GREAT COMPANIES

acf Valve Division, W-K-M Manufacturing Company, Inc., and the Key Company — all members of the acf Industrial Family — have been brought together as W-K-M Manufacturing Company, a subsidiary of acf Industries, Inc.

Management, Manufacturing and Marketing facilities of all three are now centralized in this new 12-acre completely air-conditioned office and plant at Missouri City, Texas, a few miles west of Houston.

This consolidation provides important efficiencies of production of W-K-M Through-Conduit Valves, acf Lubricated Plug Valves, Key Return Bends, and Key-Kast Welding Fittings. These products, with a long established reputation for excellent service and performance, will continue to be engineered, manufactured and sold by the same experienced personnel who were instrumental in building that reputation.

OPENING OF A GREAT NEW PLANT THURSDAY, MAY 17TH TWO to SEVEN P. M.

You are cordially invited to inspect our new Plant and Office at Missouri City, Texas, just a few miles west of Houston.

Special transportation from downtown Houston to the plant will be provided for visitors. Please write immediately for your Transportation Pass. Address W-K-M Manufacturing Company, Guest Committee, P. O. Box 2117, Houston, Texas.

W-K-M Manufacturing Company, Inc.

A subsidiary of acf Industries Incorporated

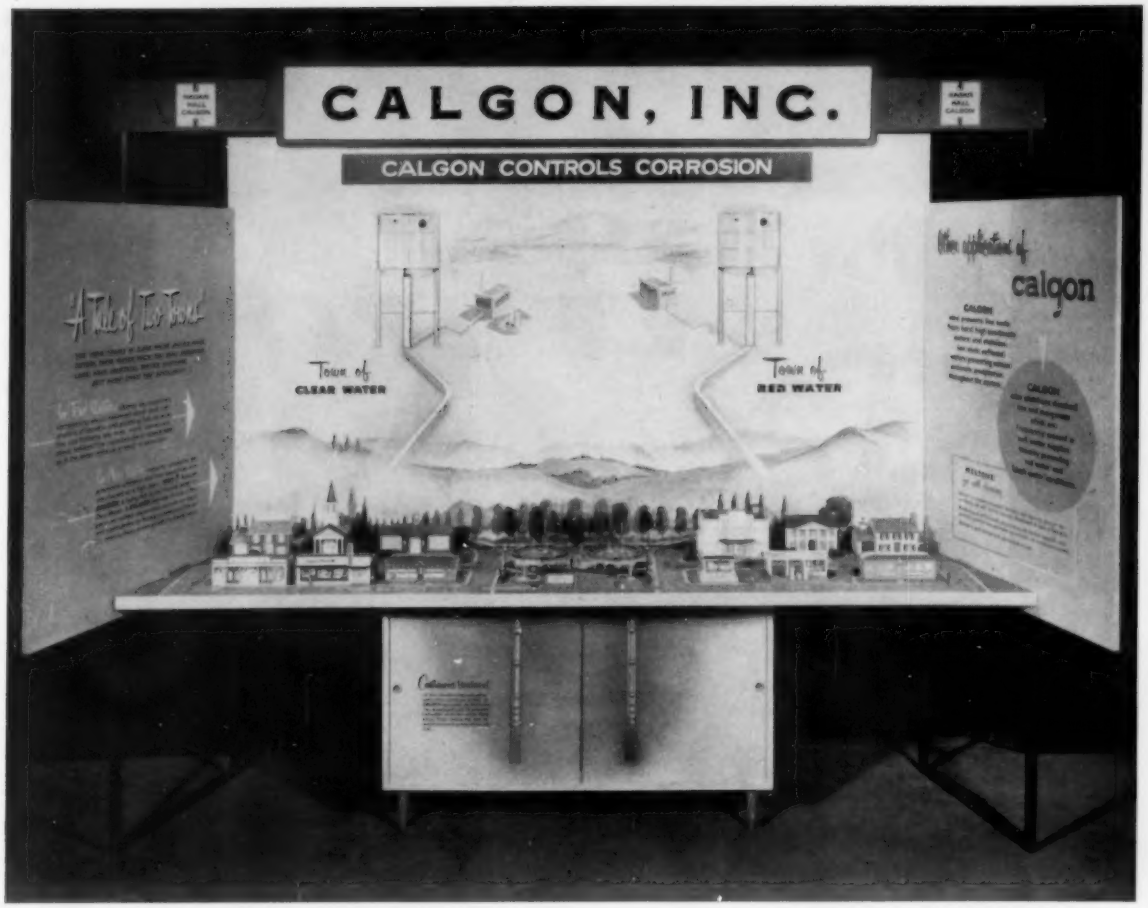
PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

acf LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS



CALGON* Stops Red Water!

MANY visitors to the AWWA Convention in St. Louis will know from their own experience that Calgon really controls Red Water, as demonstrated by the Calgon exhibit shown above. Water Superintendents from coast to coast have found that Calgon is the easiest and least expensive way to stabilize dissolved iron and manganese and to inhibit corrosion† and tuberculation in iron pipes.

Calgon is effective against lime scale formation, too, and stabilizes lime soda softened water to control calcium carbonate precipitation.

Why not stop by the Calgon booth and find out how Calgon can help you?

*Calgon is the Registered Trade Mark of Calgon, Inc. for its glassy phosphate (sodium hexametaphosphate) products.

†Fully licensed for use under U. S. patents 2,337,856 and 2,304,850.

CALGON, Inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PA.

AWWA CONVENTION

St. Louis—May 6-11

Hagan-Calgon Exhibit—Booths 10-11-12

Be sure to stop at the Hagan-Calgon Exhibit. Inspect the equipment and talk over water management problems with Hagan and Calgon Engineers.

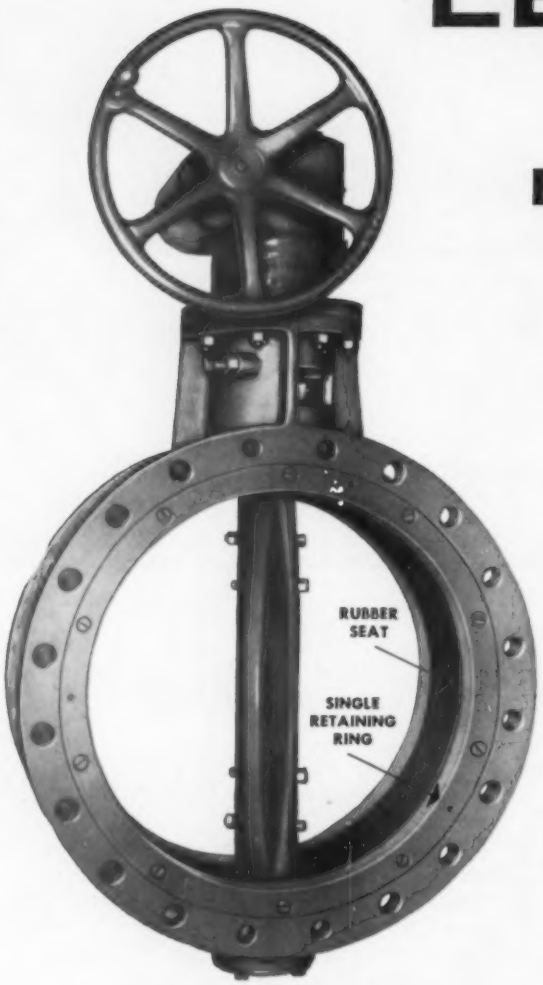
Positive drop-tight shut-off

Easy... Efficient... Economical

with

LEOPOLD

Rubber Seated BUTTERFLY VALVES



With Leopold Rubber Seated Butterfly Valves, you can be certain of quick, positive, watertight operation—year after year. Too, they're easy and economical to install and require a minimum of maintenance.

In this design, the seat is of resilient neoprene rubber or pure gum rubber, vulcanized around a steel ring insert, and held in place in the center section of the valve body by a keeper ring. This steel ring, which is "continuous" to eliminate abnormal wearing, increases the firmness of the seat and assures longer service life. Too, the valve disc is positioned at a 10° angle to provide a better fit. No other butterfly valve offers these important construction features.

Whether operated manually or by automatic controls, Leopold Butterfly Valves always give a positive shut-off that's bubble-tight. They're made in sizes 6″ to 72″, in any desired metal, to conform to AWWA specifications and to meet a wide range of operating conditions.

Write today for descriptive literature!

Leopold

F. B. LEOPOLD CO., INC.

2413 W. CARSON STREET, PITTSBURGH 4, PA.

COMPLETE WATER PURIFICATION AND SEWAGE PLANT EQUIPMENT • BUTTERFLY VALVES
FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS

YOU BUY

Advanced Engineering

When you buy Modern AMERICAN METERS

American Meters lead in advanced design features. Note the NEW transparent, hard tenite plastic register cover that seals out foreign matter if meter is flooded in a pit. There is no condensation of moisture to interfere with reading the dial. The plastic case may be filled with a clear petroleum oil through a filler plug in the top. Register and change gears thus operate in a bath of oil resulting in maximum service life. A special "O" Ring gasket seals the top and another "O" Ring seals the stuffing box shaft. To be sure the meter you buy has the latest engineering features . . . Buy American.

BUFFALO METER CO.
2209 Main Street, Buffalo 14, N. Y.

a little HTH* goes a long way in sanitizing new water mains

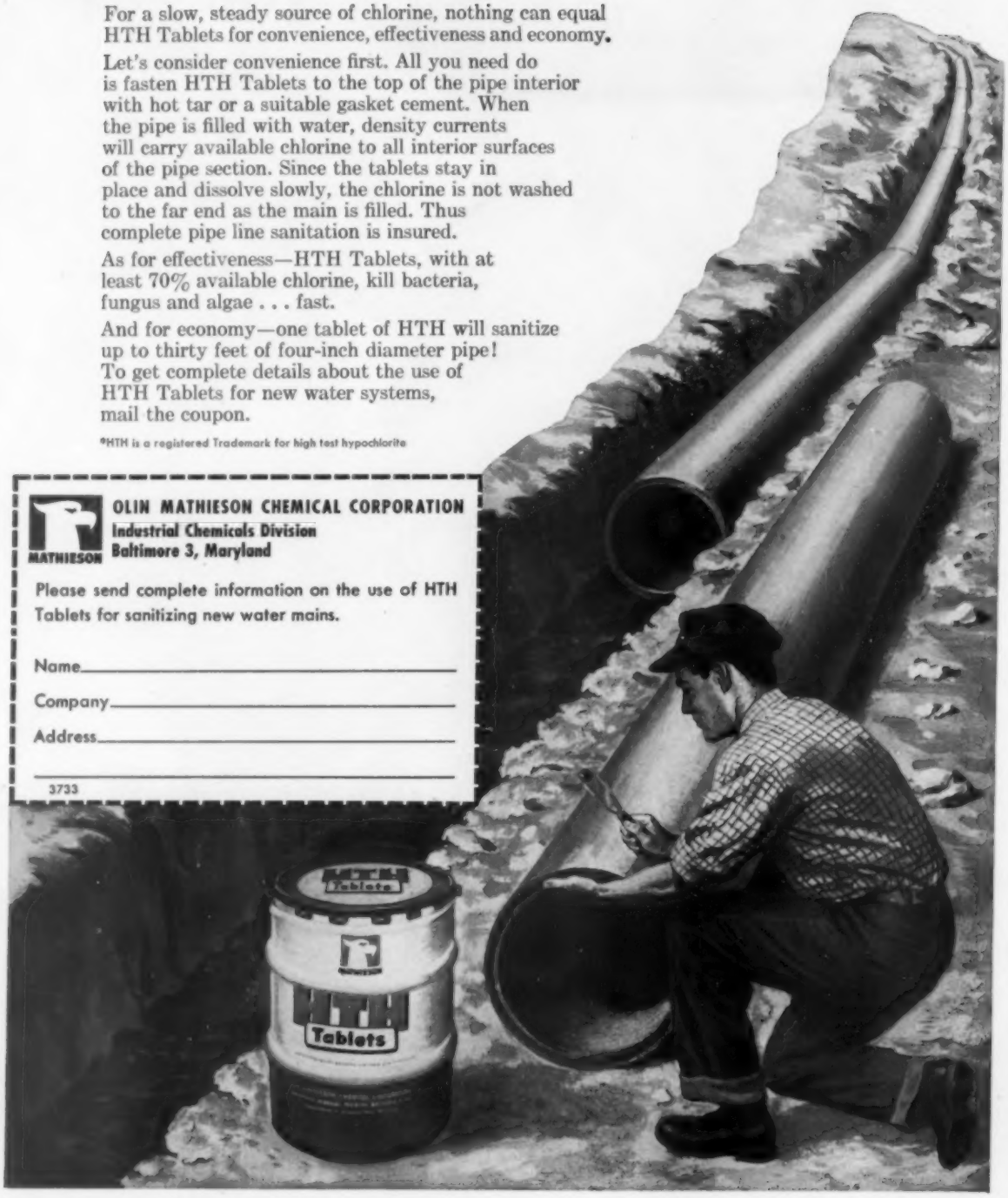
For a slow, steady source of chlorine, nothing can equal HTH Tablets for convenience, effectiveness and economy.

Let's consider convenience first. All you need do is fasten HTH Tablets to the top of the pipe interior with hot tar or a suitable gasket cement. When the pipe is filled with water, density currents will carry available chlorine to all interior surfaces of the pipe section. Since the tablets stay in place and dissolve slowly, the chlorine is not washed to the far end as the main is filled. Thus complete pipe line sanitation is insured.

As for effectiveness—HTH Tablets, with at least 70% available chlorine, kill bacteria, fungus and algae . . . fast.

And for economy—one tablet of HTH will sanitize up to thirty feet of four-inch diameter pipe! To get complete details about the use of HTH Tablets for new water systems, mail the coupon.

*HTH is a registered Trademark for high test hypochlorite



MATHIESON

OLIN MATHIESON CHEMICAL CORPORATION
Industrial Chemicals Division
Baltimore 3, Maryland

Please send complete information on the use of HTH Tablets for sanitizing new water mains.

Name_____

Company_____

Address_____

_____

3733

OLIVER 88 WT HYDRO-TRENCHER

"Outperforms any other trencher in this area!"

After digging 9,500 ft. of sewer line trench averaging 8 ft. deep in the toughest gumbo found anywhere in Western Canada, W. N. Schmidt of Ideal Plumbing and Heating Co., Ltd., of Regina, Saskatchewan, has this to say: "Our experience with the Oliver 88 Hydro-Trencher has been excellent. It will outperform any other trencher we've ever seen in this area."

And hear what he has to say about year 'round operation: "Working through the winter, we operated in temperatures as low as 20° below zero and were able to dig through 4 ft. depth of frost!"

The Hydro-Trencher is designed for tough assignments like this. Tremendous down pressures enable you to force the bucket through the hardest soils. And dual hydraulic controls give you the speed and easy handling to make fast work of any job.

Plumbing contractors, general contractors and public bodies everywhere are profiting handsomely with this dependable, high production tool. So can you. Ask your Oliver dealer to demonstrate.

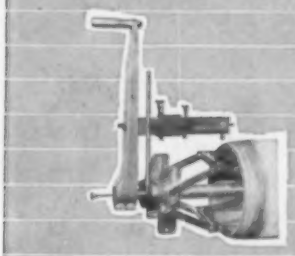
The Oliver Hydro-Trencher with ½-yd. bucket digs to 12 ft., loads to 12 ft. and provides 180° boom swing to either side; moves quickly from job to job under its own power.

THE OLIVER CORPORATION
400 West Madison Street, Chicago 6, Illinois

OLIVER

a complete line of industrial wheel and crawler tractors and matched allied equipment

PLUMBERS — CONTRACTORS — WATER AND SEWAGE WORKS OFFICIALS



"Spring Load" Tools will Save You Time and Money

Thousands of plumbers, and contractors, water and sewage department officials, public works department heads and others specify "Spring Load" because they know these tools do the job quicker and with less maintenance. To save time is to save money . . . and you can do it with Spring Load cutters, tenon tools and vises. The right tool for every job is a good investment.

MODEL B TENON TOOL

4" to 8" pipe . . . $195.00 **10" to 20" pipe . . . $315.00**

Recommended by leading asbestos-cement pipe manufacturers, the Model B is the only tool which will make all the cuts and profiles necessary for modern asbestos-cement pipe installations. Saves engineering time by eliminating the need for figuring and specifying short lengths.

- **Ring-Tite Couplings**
- **Fluid-Tite Couplings**
- **Simplex Couplings**
- **Roto-Split Flanges**
- **Poured Flange Assembly**
- **Tapered Couplings**
- **Making Closures and End Facing**

Completely automatic feed and quick release make the Model B the fastest tenoning tool developed to date. Simply change the cam plate to adapt the tool for cutting any type profile.

TENON TOOL ALSO AVAILABLE IN A STANDARD MODEL FOR SIMPLEX COUPLINGS ONLY — 4" to 8" pipe $90.00 10" to 20" pipe $172.00

CAST IRON AND STEEL PIPE CUTTERS

Model 6 cuts Cast Iron, Duriron, Vitreous Clay Water pipe and Cement Sewer Tile — 2" to 6" pipe . . . $42.50

Model 12 cuts Cast Iron, Duriron, Vitreous Clay Cement Sewer Tile and Steel (with simple changeover to steel wheels) — 4" to 12" cast iron pipe, etc. $84.75

For 4" to 12" for steel pipe only $89.95

Both of these Spring Load Pipe Cutters are heavy duty, precision-built steel-cast cutters designed to exert equal pressure all around the pipe. Cuts are clean and straight, without ears, depressions or splits. Simple and easy to use, the cutters are as practical in the field as in the shop or on the stock pile. Cuts pipe many times faster than ordinary tools and methods.

ASBESTOS-CEMENT PIPE CUTTER — 2" to 8" pipe . . $75.00

You get easy, fast and clean cutting on any asbestos-cement pipe with this on-the-job tool. Practical in the field, at the shop and on the stock pile. Field proven, this tool reduces cutting time 50%. Lightweight—easy to use—no pipe spoilage. Extensions available to increase capacity to 24" pipe.

GRAVITY GRIP VISES

No. V-6 — for 2" to 6" cast iron and steel pipe $24.75

No. V-12 — for 6" to 12" cast iron or steel pipe 44.75

No. V-20 — for 4" to 20" asbestos-cement and clay pipe . . . 44.75

The quickest set-up for holding pipe ever devised. Especially designed for use with Spring Load Cutters and Tenon Tools, the Gravity Grip Vise firmly holds the pipe at a convenient working height and angle.

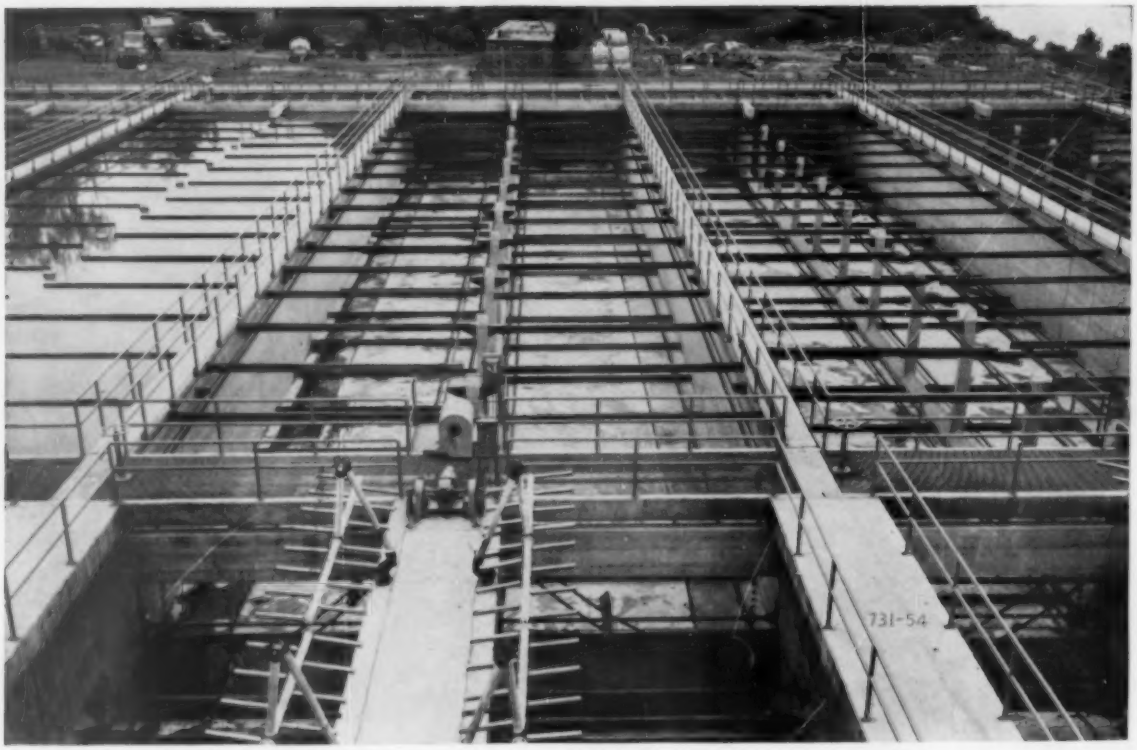
Send for descriptive literature and price list.
All Spring Load tools are unconditionally guaranteed against faulty workmanship or faulty materials.

SPRING LOAD

MANUFACTURING CORPORATION

3610 First Avenue South Seattle 4, Washington

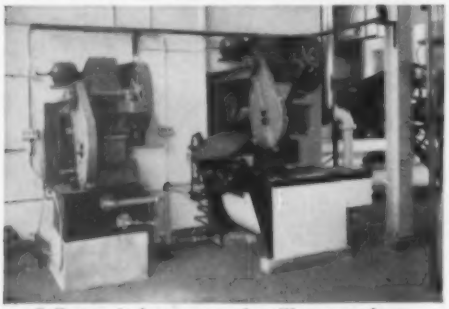
See you in St. Louis
Meet with us at
booths 67-68
"Headquarters"—Jefferson Hotel
WATCH DOG
WORTHINGTON-GAMON METER DIVISION
Worthington Corporation
NEWARK NEW JERSEY



Jeffrey collectors for removing settled sludge

It's the trend.... two communities team up with **JEFFREY'S** help on a modern, efficient sewage disposal plant

Jeffrey belt conveyor carrying sludge to driers



Jeffrey spiral conveyors handling coagulants

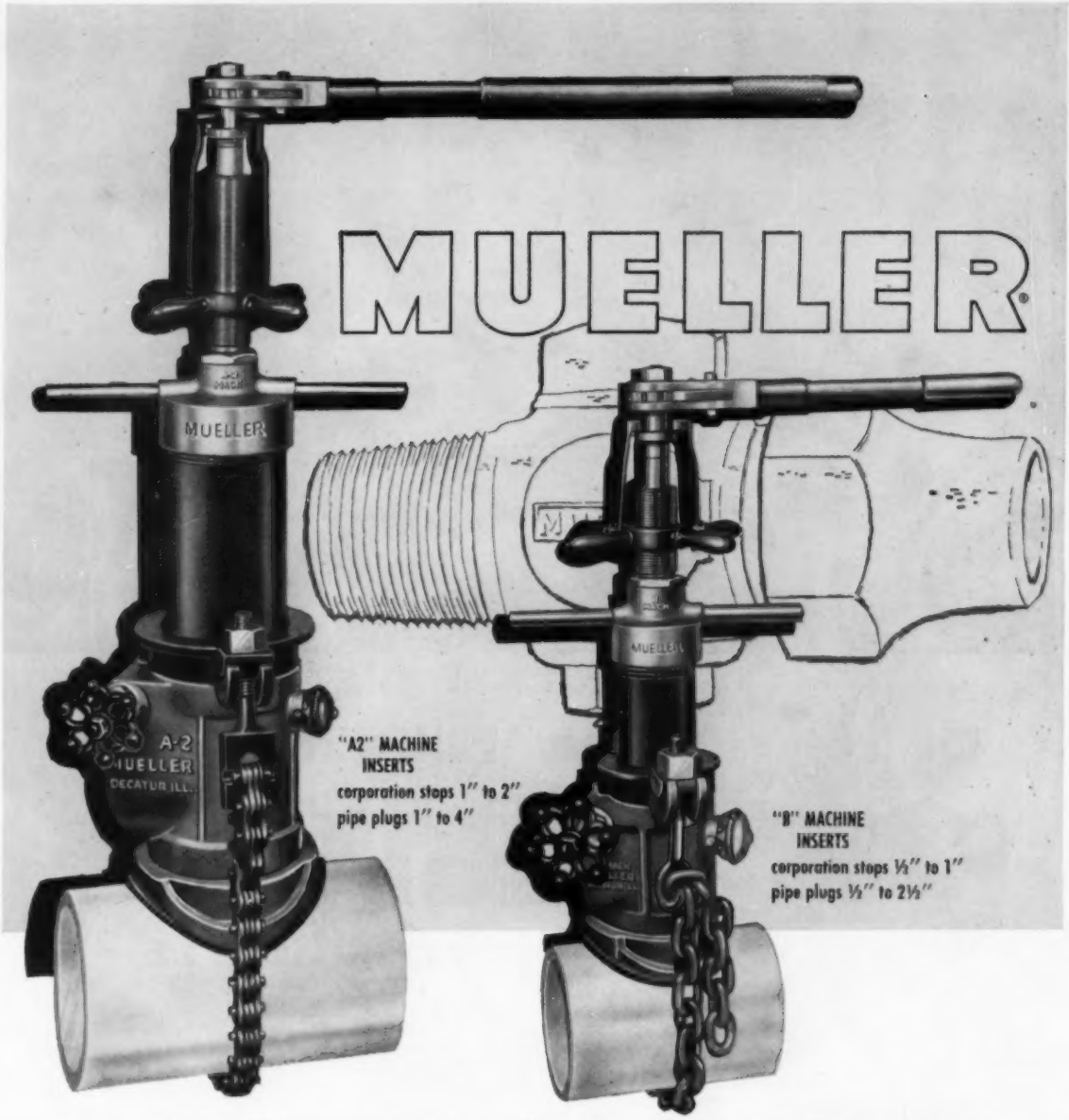
● Campbell and Kenton counties joined forces to plan and construct this sewage treatment plant at Bromley, Kentucky. Both profited since a larger, more efficient plant could be built, and operation is concentrated under a single head.

This cooperative idea is gaining ground rapidly; Jeffrey engineers are working similarly with other groups. Their broad experience in the design and construction of sanitation systems covers all kinds of treatment needs. Jeffrey equipment can be depended upon to perform well and faithfully.

You can turn your sanitation problem over to Jeffrey engineers with complete confidence. The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT • TRANSMISSION MACHINERY • CONTRACT MANUFACTURING



Insert Corporation Stops Under Pressure

Drill the main, tap the hole and insert corporation stops with the Mueller "B" or "A-2" Tapping Machine. Or you can use them to remove and replace old corporation stops or insert pipe plugs—*all under pressure.*

Drilling and tapping operation are done simultaneously with a combined drill and tap. Both machines use a single boring bar for drilling, tapping and inserting operations. This assures accurate alignment for inserting the stop—eliminates the possibility of cross-threading.

Combination by-pass and test valve relieves pressure and permits operator to check for leakage after stop is inserted and before machine is removed.

Refer to Mueller Catalog W-96, contact your Mueller Representative, or write direct for complete information.

MUELLER CO.

Dependable Since 1857

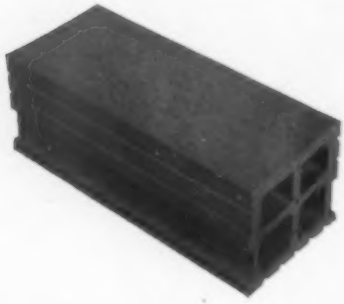
MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Photograph of Northeast Station under construction. Designed by City of Detroit, Department of Water Supply.

Detroit's Latest Filtration Plant

equipped with

LEOPOLD Filter Bottoms



LEOPOLD FEATURES

Resists corrosion • Are not subject to tuberculation • Require only small sized gravel • Provide uniform wash distribution • Will last indefinitely.

The new Northeast Station in the City of Detroit, scheduled for completion in 1956, is one of the major projects included in the water department's expansion program. Constructed at a cost of approximately $35,000,000, this outstanding installation has 48 rapid sand filters and a rated capacity of 192 MGD.

For this ultra-modern plant, Leopold Glazed Fire Clay Tile Filter Bottoms are being used—as they are in over 325 plants throughout the country (with a daily capacity of close to two billion gallons). And Leopold Bottoms are getting more popular every year!

Whether building new construction or modernizing present facilities, it will pay you to consider the many advantages offered only by Leopold. We'll be glad to supply details and to discuss your requirements—without obligation.

Write today for details!

Leopold

F. B. LEOPOLD CO., INC.

2413 W. CARSON STREET, PITTSBURGH 4, PA.

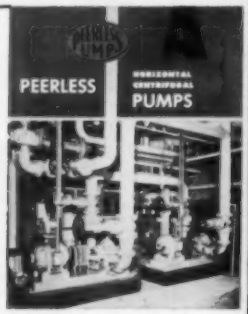
COMPLETE WATER PURIFICATION AND FILTER PLANT EQUIPMENT • BUTTERFLY VALVES

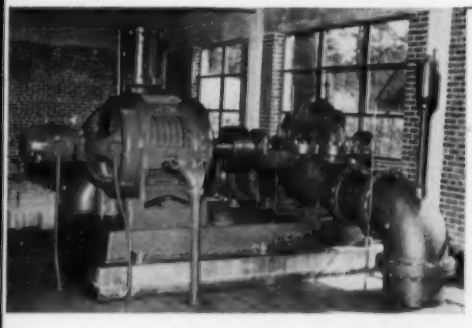
FILTER OPERATING TABLES • MIXING EQUIPMENT • DRY CHEMICAL FEEDERS

look AT THE PUMPING PROBLEM *two ways*

VERTICAL

HoRizontal





PEERLESS PUMP DESIGNS PROVIDE THE RIGHT TYPE FOR DOING THE JOB BETTER

You pick the design; Peerless will supply the pump. From one of the broadest range of pump capacities, heads, horsepowers, you can choose a Peerless horizontal or a Peerless vertical pump for almost every liquid transfer job, involving either water or process liquids.

In the picture at the top above, a concentrated solution of sulphuric acid and aluminum sulfate is being pumped by Peerless vertical industrial service pumps. To find out all about them request Peerless Bulletin No. B-505.

The Peerless horizontal type A pump shown just above, is one of three that supplies plant water for a textile mill. To find out all about them request Peerless Bulletin B-1300 and B-1350.

Use the coupon below to find how these Peerless designs can meet all your pumping needs with economy, efficiency and dependability.

PEERLESS PUMPS

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles 31, Calif., and Indianapolis 8, Ind.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis, Ind.; Phoenix; Fresno; Los Angeles; Plainview and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities. Consult your Telephone Directory.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send bulletins checked below:

- ☐ PEERLESS INDUSTRIAL SERVICE PUMPS (B-505)
- ☐ PEERLESS TYPE A HORIZONTAL PUMPS (B-1300)
- ☐ AND TYPE AS (B-1350)

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COMPANY_____

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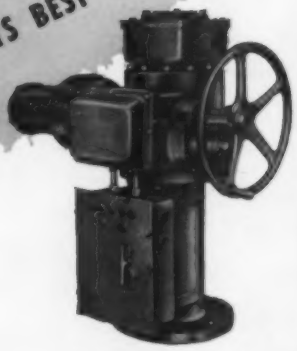
CITY_____ STATE_____

WSW

VALVE ACTUATION

ENGINEERING AT ITS BEST



Motor Operated Stand with Integral Control Equipment.

MOTOR OPERATED VALVE

Power actuation is available as a complete carefully engineered unit. Actuation may be by electric motor, air motor, or air or fluid cylinder type motivation. The power unit is compact and self contained, with sturdy supports which attach to the top of any Ludlow Valve.

Manual operation is provided for all electric and air motor operated valves. Our engineers will be glad to help you lay out a plan based on the many years of Ludlow experience in power actuation systems of all kinds for all purposes.

"NO POSSIBLE DIFFERENCE IN FIRST COST CAN OVERBALANCE THE PERPETUAL ECONOMY OF QUALITY."

19

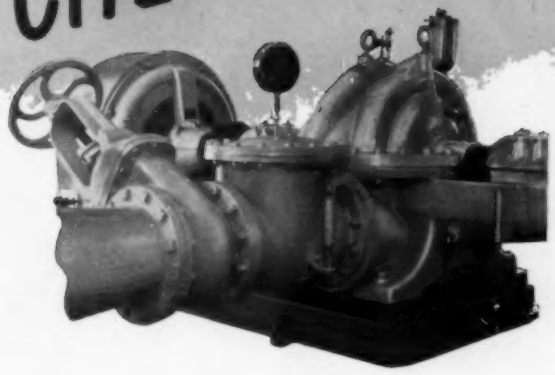
CYLINDER OPERATED VALVE

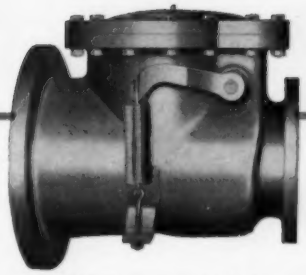
THE LUDLOW VALVE MFG. CO., INC. TROY, N.Y.

TRADE LUDLOW MARK

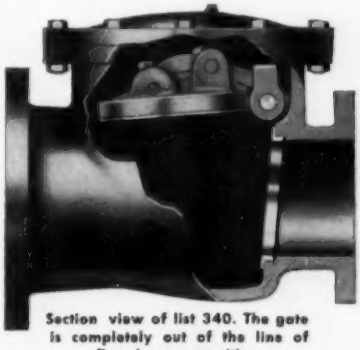
GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES
CHECK VALVES • TAPPING SLEEVES • AIR RELEASE VALVES

CLEARWAY—QUIET CLOSING CHECK VALVES





List 340 Clearway, quiet closing check valve: increasing type with flange ends.



Section view of list 340. The gate is completely out of the line of flow in open position.

Low cost insurance against severe slam on pump shut down is provided in the Rensselaer clearway, quiet closing, non-slam check valve.

In operation, the gate is normally completely out of the line of flow and head losses are extremely low, even at high velocities. The lever arm and adjustable spring force the gate toward its seat on pump shutdown and the gate seats firmly at the instant of zero velocity, without slamming.

The List 340 Spring Check Valve may be installed in either horizontal or vertical pipe lines and is made in sizes up to 30 inch and pressures of 200 lbs. with flange ends only. Dual levers and springs may be provided for extreme conditions. All parts are readily accessible through the large removable cover.

The increasing type illustrated bolts directly to the pump discharge flange, eliminates increasers and saves valuable space. For locations where slamming is not anticipated, the Rensselaer list 37 without lever and springs is recommended. For higher pressures, the List 39 operates on non-shock cold water, oil or gas up to 400 lbs. W.P.

22

Ask for Bulletin "E"

Rensselaer VALVE CO. **TROY, NEW YORK**

DIVISION OF THE LUDLOW VALVE MANUFACTURING CO., INC.

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES
CHECK VALVES • TAPPING SLEEVES • AIR RELEASE VALVES

"careful, Orgie, the guide book says the water is treated with PITTCHLOR® !"

That's right, Orgie. One splash with Pittchlor-treated water and your tour is over. Pittchlor is instant death to chlorine-susceptible bacteria and algae.

A stable, high-test calcium hypochlorite containing a minimum of 70% available chlorine, Pittchlor works fast and effectively in chlorinating water supplies, treating sewage, or wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Cincinnati • Charlotte • Chicago • Cleveland • Boston New York • St. Louis • Minneapolis New Orleans • Philadelphia • Houston Pittsburgh • Dallas • San Francisco
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

For water purification, sewage treatment, swimming pool sanitation

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

DARLING ... HYDRANTS

- **Featuring new ball-bearing operated B-50-B design**
- **Types and sizes for every requirement**

YOU'LL be ahead on many counts when you specify modern Darling Fire Hydrants. Just for example . . .

Your system can include hydrant types exactly right for special or unusual service needs — breakable coupling types where traffic damage is common, concealed flush types for airport and pavement installation, Tee-base types to eliminate lateral connections where practicable. These and a few of the other types are shown here.

Equally important, Darling's unique B-50-B development (now available in all except the Tropical type) introduces *ball-bearing* operation combined with "O" ring seals. Result: a packless, dry-top hydrant. No packing gland maintenance. Operating threads and bearings *stay* lubricated and water can't reach them. Operation is far easier, far faster . . . and you avoid lots of maintenance time and trouble.

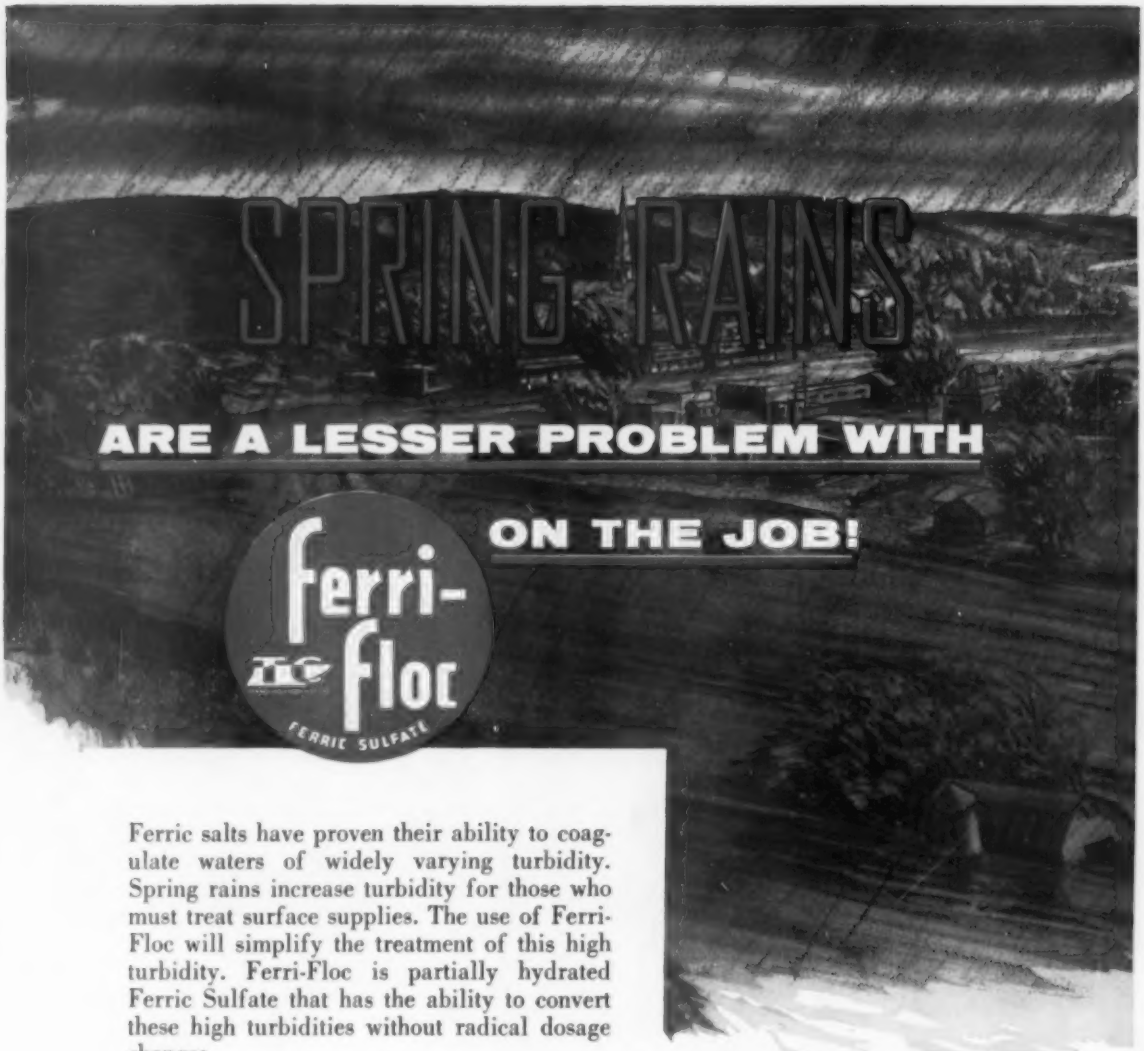
Send for complete information. Better still, ask to have a Darling engineer check your needs and tell you just what you stand to gain with Darling Hydrants.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.



Ferric salts have proven their ability to coagulate waters of widely varying turbidity. Spring rains increase turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is partially hydrated Ferric Sulfate that has the ability to convert these high turbidities without radical dosage changes.

- **Excellent taste and odor control**
- **Increased filter runs**
- **Coagulation over wide pH ranges**
- **Rapid floc formation**
- **Bacteria removal**
- **Turbidity removal**
- **Ease of Operation**
- **Manganese and Silical removal**
- **Color removal**
- **Economy**

WATER TREATMENT

Efficient coagulation of surface or well waters. Aids taste and odor control—Effective in lime soda-ash softening. Adaptable to treatment of nearly all industrial waters.

SEWAGE TREATMENT

Ferri-Floc coagulates water and wastes over wide pH ranges—It provides efficient operation regardless of rapid variations of raw sewage, and is effective conditioning sludge prior to vacuum filtration or drying on sand beds.

TENNESSEE CORPORATION

617-29 Grant Building, Atlanta, Georgia

SULFUR DIOXIDE HIGHEST QUALITY SO_2

SULFUR DIOXIDE

SULFUR DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE

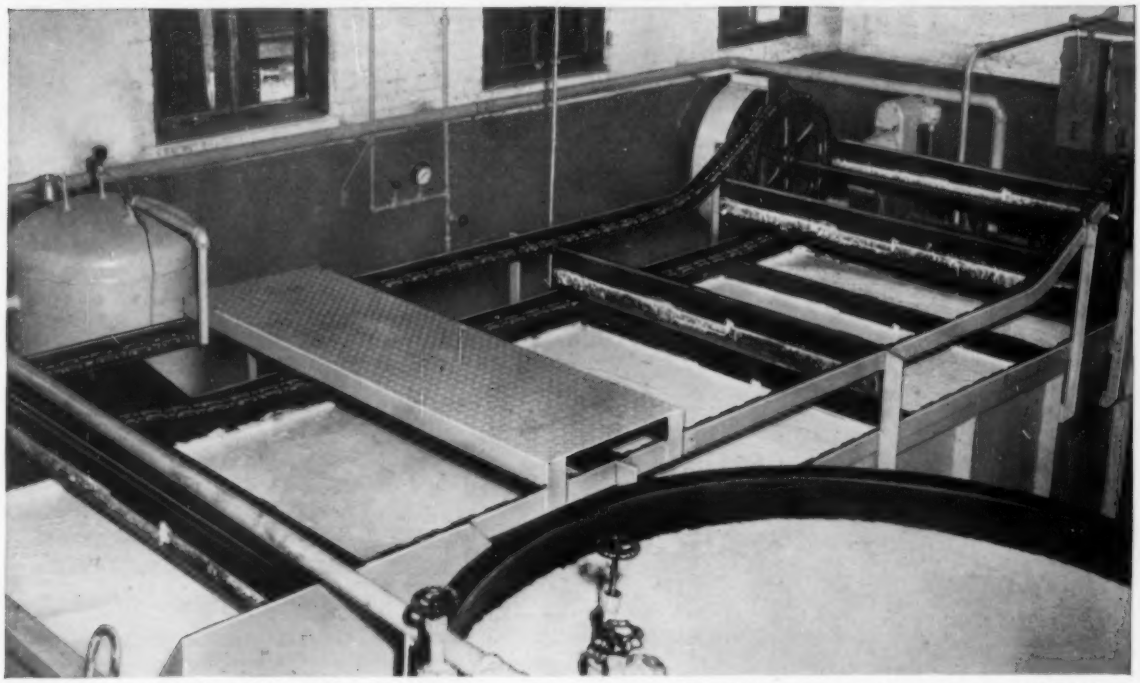
COPPER SULFATE

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment more economically than any other chemical.

FREE BOOKLET

Let us send you without charge, a 38 page booklet that deals specifically with all phases of coagulation—just send us a postal card.

FLOTATION IS *ONE* EASY WAY...



A typical example of Rex Float-Treat's ability to handle industrial waste. Valuable fats are recovered in this large meat packing plant.

To recover materials – eliminate pollution – clarify water for re-use

For industrial waste treatment...in oil refineries, tanneries, meat packing and food processing plants, chemical plants and many other places, Rex Float-Treat offers a proven way of recovering oils, fats, grease and other materials, clarifies process water and liquids for re-use, and reduces pollution.

Rex Float-Treat eliminates the pumping of raw influent liquids so breakup of delicate, light solids ... the emulsification of valuable fats and oils ... is avoided. Because only recycle is pumped, operating costs are substantially reduced.

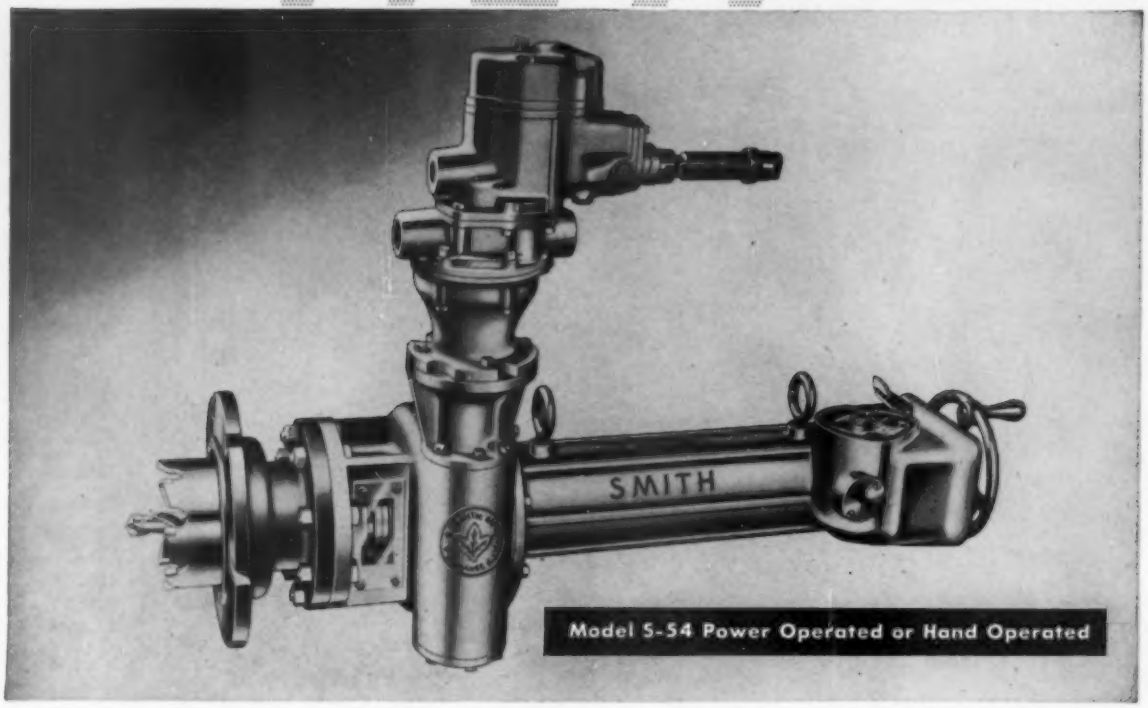
Float-Treat is available as a completely packaged unit in a metal tank or can be furnished for concrete tank installation.

Rex Float-Treat is only one method of treating industrial and municipal wastes. Equipment is also available for screening, settling and grit removal. Get all the facts, today! Write CHAIN Belt Company, 4617 West Greenfield Avenue, Milwaukee 1, Wisconsin.

CHAIN BELT COMPANY

MILWAUKEE 1, WISCONSIN

NEW
SMITH TAPPING MACHINES FOR TAPS 2″ THRU 12″ INCLUSIVE



Model S-54 Power Operated or Hand Operated

The A. P. Smith Mfg. Company in 1896 introduced the first Tapping Machine for making connections sizes 2″ and larger to fluid and gas service piping under pressure. The *NEW* Smith S-54 Tapping Machine is the most modern, efficient and economical machine available. The S-54 Smith Tapping Machine is used with Tapping Sleeves, Hat Flanges, Saddles and Tapping Valves to make 2″ through 12″ connections under pressure to Cast Iron, Cement-Asbestos, Steel and Reinforced Concrete Pressure pipe. 1. AUTOMATIC FEED: Positive automatic feed insures correct drilling and tapping rate. Hand feed is provided to rapidly advance and withdraw Cutter. 2. TRAVEL INDICATOR: Chart attached to machine indicates travel required to complete tap. Travel is *AUTOMATICALLY* terminated when tap is completed. Cutter and shaft cannot overtravel. 3. COMPACT CONSTRUCTION: Telescopic shaft reduces overall length. 25″ travel is adequate for 2″ through 12″ taps to any size of pipe. 4. ENCLOSED CONSTRUCTION: Mechanism is housed in heat treated Aluminum Case filled with lubricant. Foreign matter cannot enter and damage mechanism. 5. STUFFING BOX AND PACKING GLAND: Accessible without disassembling machine. Equipped with Chevron packing. Line pressure cannot enter machine case. 6. RUGGED CONSTRUCTION: Extra large diameter telescopic shaft adds strength and rigidity. Timken radial—thrust bearings maintain alignment, reduce friction and wear. 7. DRIVING GEARS: Worm gearing operates in lubricant, torque is reduced to the minimum. 8. CUTTERS: Have replaceable Flat and Semi-V alternate teeth of High Speed Steel or Tungsten Carbide. 9. FLEXIBILITY: Hand Operated Machines can be converted to Power Operation by interchanging worm gearing. 10. AIR MOTOR: The motor attaches directly to the Power Operated Machine without Brackets, Holders, Adapters or Couplings. Bulletin sent on request.

52

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

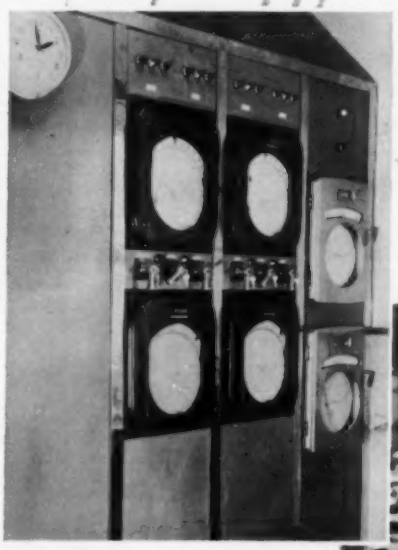
EAST ORANGE, NEW JERSEY

NOW AUTOMATIC ECONOMICAL OPERATION FOR WATER AND SEWAGE PLANTS

NEW TALLER & COOPER REMOTE & LOCAL CONTROL SYSTEMS

- **Automatically supervise and control pumps, valves, pressures, flows and other functions over a single pair of wires**
- **Maintain standards of quality with maximum efficiency at lowest cost**
- **Provide automatic continuous and permanent record of every part of the system's operation**

Taller & Cooper Remote and Local Control Systems are designed to offer instantaneous confirmation of an unlimited amount of executed plant operations. Not only for water supply, but also for chemical and material supply systems in industry, Taller & Cooper systems fulfill the need for accurate monitoring, control and centralized information concerning feed and flow installations actuated from a central office, or operated locally, manually.



A typical forward-looking water program which has found its profitable answer in Taller & Cooper Remote Control Equipment. Graphically showing at all times are water pressures, levels, flows and condition of pumps and tanks in all field stations.

Write today for illustrated folder—503-C, detailing on actual case history and experience records with T&C Equipment.

TALLER & COOPER, INC.
ENGINEERS • MANUFACTURERS
75 Front Street, Brooklyn 1, N. Y.

- Control Equipment & Systems • Wind Tunnel Instrumentation
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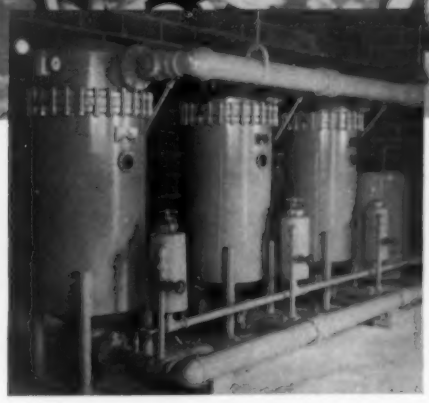

Diatomite filters with ALOXITE® tubes give low-cost, dependable swimming pool filtration

Built by Proportioneers, Inc., Division of B.I.F. Industries, Inc., the diatomite filters shown at right effectively filter swimming pool water season after season . . . without excessive maintenance.

Contributing to their successful, economical operation are the Aloxite® aluminum oxide porous tubes or septa that support the diatomite. These have many inherent advantages. For example, pore area is a high percentage of their total area. Pre-coat builds up uniformly. Backwash is uniform and effective. The Aloxite® septa are fine enough to give partially effective filtration without the diatomite in periods of emergency. And they resist acids — which permits cleaning of units clogged by iron and other materials.

This informative 56 page booklet covers porous media for all fields of filtration and diffusion. Write us for your free copy today.

CARBORUNDUM
Registered Trade Mark

Dept. X56 Refractories Division
Perth Amboy, New Jersey

PENNSALT CHEMICALS for Water and Sewage Treatment

1 CHLORINE

A uniform quality water works grade of chlorine. Used by hundreds of cities and communities throughout the West because of confidence of PENNSALT'S Quality Control of the product. Shipped in 100 and 150 pound cylinders and one ton containers by rail, truck and water.

2 AMMONIA, Anhydrous

Water works grade, shipped in modern, lightweight cylinders which saves considerable freight cost and lightens the burden of handling. 50, 100, 150 pound cylinders.

3 PERCHLORON®

High-test calcium hypochlorite containing 70% available chlorine. Shipped in 100 pound drums; cases—9 5-pound cans to case.

4 CLOR®

A concentrated solution of sodium hypochlorite guaranteed 15% minimum available chlorine. Packaged in five gallon containers.

PENNSYLVANIA SALT MANUFACTURING COMPANY OF WASHINGTON

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Pennsalt Chemicals

Together for 25 years!

We Offer a Toast

We raise our glass of palatable water to our many friends in the water works field as a salute to our Silver Anniversary together. It's been a happy association and a genuine pleasure! To all of our old and new users of Aqua Nuchar, we wish to take time on this happy occasion to say: Thanks for the privilege of serving you, and may this marriage go on and on like Ole Man River.

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division west virginia pulp and paper company

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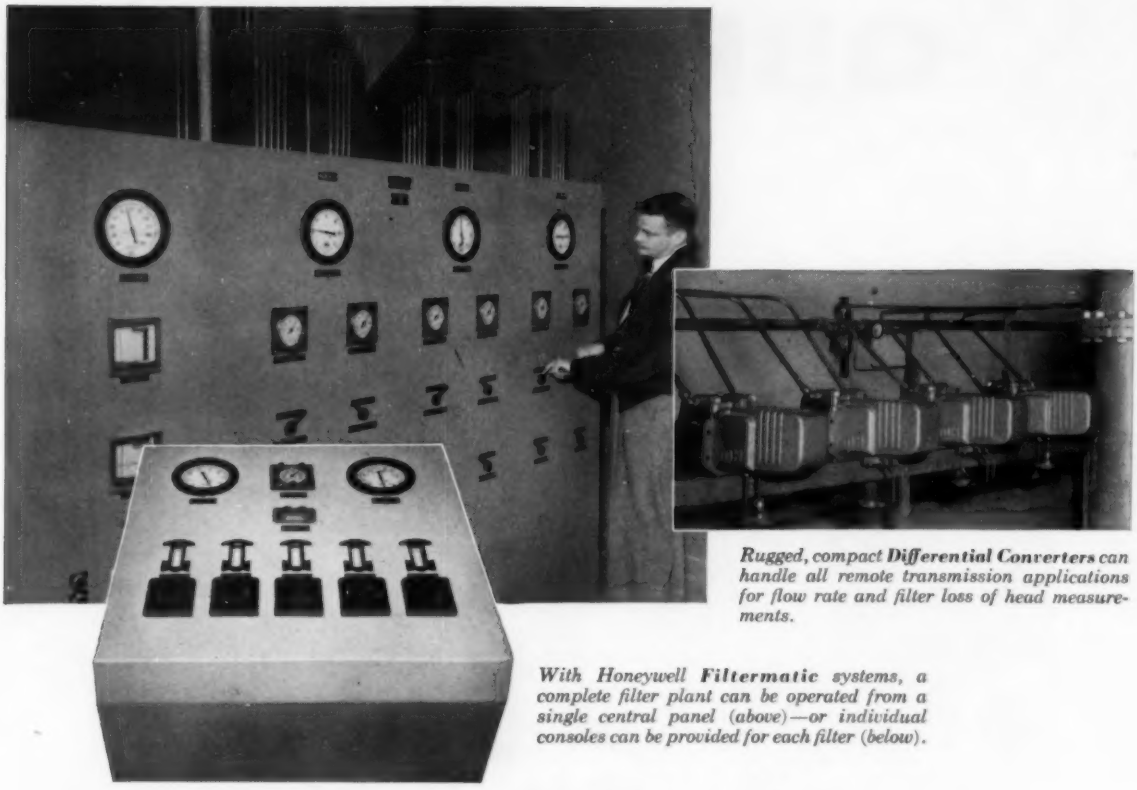


Rugged, compact ***Differential Converters*** *can handle all remote transmission applications for flow rate and filter loss of head measurements.*

With Honeywell ***Filtermatic*** *systems, a complete filter plant can be operated from a single central panel (above)—or individual consoles can be provided for each filter (below).*

Honeywell *Filtermatic** Systems give you *centralized automatic* control of your filtration plant

YOU CAN put a new kind of operating economy and simplicity into your water filtration plant, with Honeywell *Filtermatic* systems. These modern filter control systems give you a unique combination of design, operating and maintenance features.

Flexible control. Filtration and backwashing can be regulated by any of a variety of methods, at the operator's discretion. He can choose manual, semi-automatic, or remote manual operation. Or he can have automatic control established by pre-set flow rates, clearwell level or water usage.

Flexible design. Free from limitations of cables and mechanical linkages, *Filtermatic* systems are easily designed into central control panels in laboratory or office. Or, individual operating consoles can be provided on the filter floor.

Simple installation. Components are compact . . . require less space in pipe gallery or on the operating floor. First cost is low, installation is easy on either new or existing filters.

Simple maintenance. Built of rugged elements, *Filtermatic* systems function continuously with minimum attention. Use of interchangeable units—the same *Differential Converter* transmitters, for instance, for level, flow rate, differential pressure—reduces spare parts requirements. The system uses clean, dry air, so pipe galleries stay clean and corrosion problems are reduced.

Ask your local Honeywell sales engineer to discuss your specific filter requirements . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

* Tradename of Minneapolis-Honeywell Regulator Co.

OUR FUTURE IS (and in your

MODERNIZED **cast iron**

IN THE SKIES... hands, too)

To keep pace with America's constantly increasing demand for water, you need the help of the elements. And the public.

We can lend a hand there.

Our national advertising stresses advance planning of water facilities . . . warns millions of Americans—homeowners, apartment dwellers, industrialists about waste, pollution, the need for efficient water systems. It points out the need for new water sources, adequate treatment and distribution, realistic water rates, far-sighted water legislation . . . all the facts the public must know to cooperate intelligently with you and your fellow water officials in your difficult job of keeping America plentifully supplied with water—now and in the future.

CAST IRON PIPE. Serves for Centuries!

For over 70 public utilities in the United States and Canada, cast iron mains laid over a century ago are still serving dependably. This long, trouble-free service means lower maintenance costs . . . fewer tax dollars expended . . . fewer headaches for the waterworks officials who specify cast iron.

And today, modernized cast iron pipe, centrifugally cast, is even more rugged, uniform, durable. When needed, it's available with cement-lining to assure sustained carrying capacity throughout its generations of service.

The next time you plan extensions to your distribution system remember, cast iron pipe means the ultimate in long term reliability and economy.

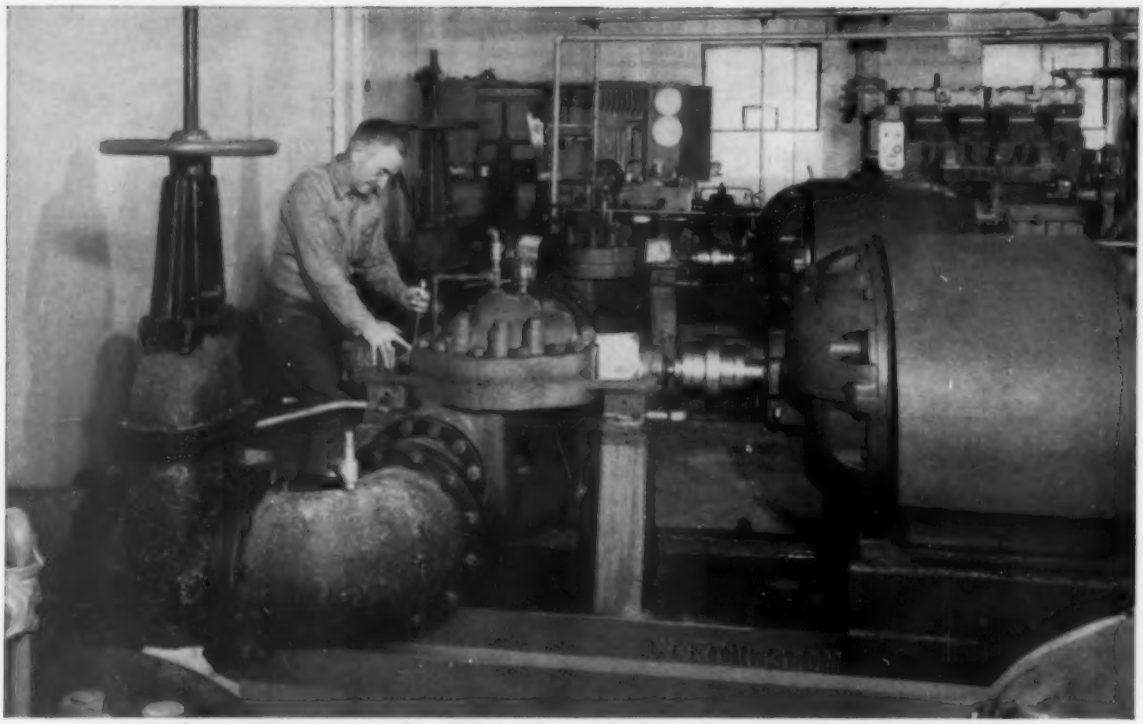
Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3, Illinois.

This rugged old cast iron water main, still serving and saving tax dollars for the citizens of *Detroit, Michigan,* is now in its 115th year of dependable service.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe FOR MODERN WATER WORKS



SIX MILLION GALLONS of water per day are delivered to City of Colorado Springs by three Worthington 400-hp centrifugal pumps, like that in foreground, at Lake George Pumping station. A 200-hp engine-driven Worthington is on standby service. This installation was engineered by Black and Veatch Co. of Kansas City, Mo.

15 Worthington pumps supply water to fast-growing Colorado Springs

THREE 300-HP WORTHINGTON vertical turbine pumps move well water from common sump to Colorado Springs' Fort Carson supply line.

A population up 50% in 10 years, an expanding industry, the new Air Force Academy—all these have spurred the demand for water in the City of Colorado Springs.

The job of supplying the city with an additional 6 million gallons of water a day falls to the Worthington-equipped Lake George and Secondary Pumping stations. Together, these stations pump water through a total pipeline distance of 92,810 feet with a lift of 1,580 vertical feet. Each station contains three 400-hp Worthington centrifugal pumps each of 2-mgd capacity. A 200-hp gasoline-engine-driven pump on standby service in each station provides minimum flow in case of power failure to prevent possible freezing of the lines.

Colorado Springs also obtains water from Fountain Creek Valley. This water is pumped to a common sump by four 30-hp pumps and from the sump to the distribution system by three 300-hp pumps—all seven pumps being Worthington vertical turbines.

The Colorado Springs water works installation is typical of thousands using rugged, reliable Worthington public works equipment—pumps, engines, compressors, turbines. Worthington engineers will be glad to help you apply this equipment to *your* water works or sewage needs. Write Worthington Corporation, Public Works Division, Harrison, N. J. W. 6.1

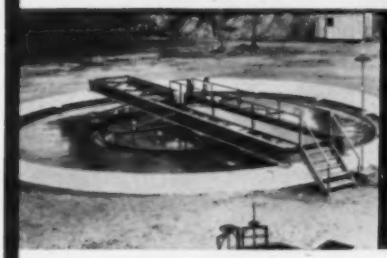
WORTHINGTON

ALL MAJOR PUBLIC WORKS EQUIPMENT UNDER ONE RESPONSIBILITY

Water Works Pumps • Sewage Pumps • Comminutors • Vertical Turbine Pumps • Vacuum Pumps

YEOMANS MANUFACTURES THE MOST COMPLETE LINE OF APPLICATION-DESIGNED SEWAGE TREATMENT EQUIPMENT

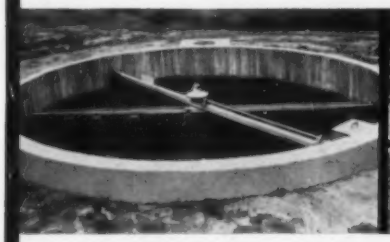
which includes..

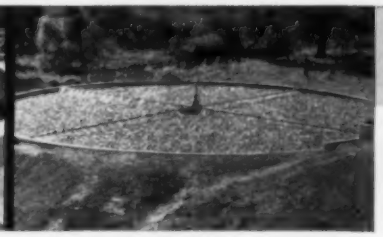


. . SPIRAFLO CLARIFIER for both primary and final clarification of domestic and process wastes. A clarifier of radically different design, the Spiraflo offers complete settleable solids removal; greater removal of finely divided particles; positive grease, scum oil removal; uniform velocity throughout tank; and straight wall design which reduces construction costs.

. . the HI-CONE, the most important development in the surface aeration process of activated sludge treatment in the last 30 years. The Hi-Cone offers much greater circulation, and can handle substantially more sewage with no increase in power consumption per MG treated. Maintenance costs are minimized because nothing can clog.

. . the CAVITATOR, a newly developed Yeomans unit for low cost treatment of both domestic sewage and industrial wastes. Perfectly suited for small communities, subdivisions, motels, resorts, schools and industrial plants, the Cavitator has excellent purification efficiency, extremely high oxygen transfer efficiency, and extremely low air requirements per pound of B.O.D. removed.





. . the WATER-WHEEL, a rotary distributor used with trickling filter systems in the secondary treatment of sewage. An exceptionally rugged, yet simple piece of equipment, the Water-wheel provides uniform distribution over the entire filter bed at all flow rates . . even the lowest. Costly accessories, such as underground feed pipe, dosing chamber with siphon, center support, and mercury seal, are not required.

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WATER & SEWAGE WORKS

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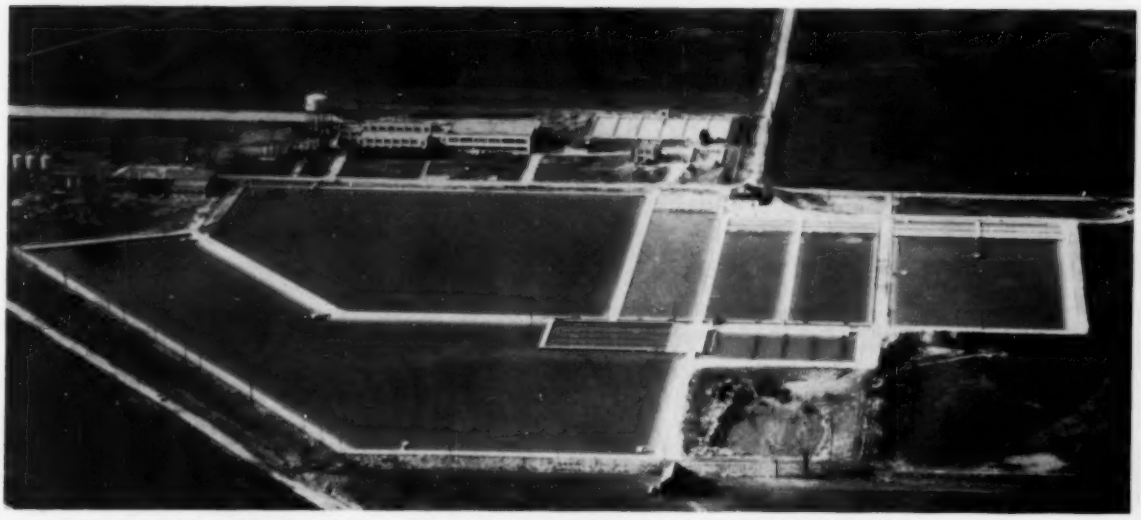


Pl. 1—CENTRAL County Plant with its 36-mgd addition now has a capacity of 85-mgd (See also Pl. 6)

St. Louis County Water Co. Expands

Finds Pronounced Revision of Design Factors Necessary If Modern Water Demands Are to be Met

by FRANK E. DOLSON

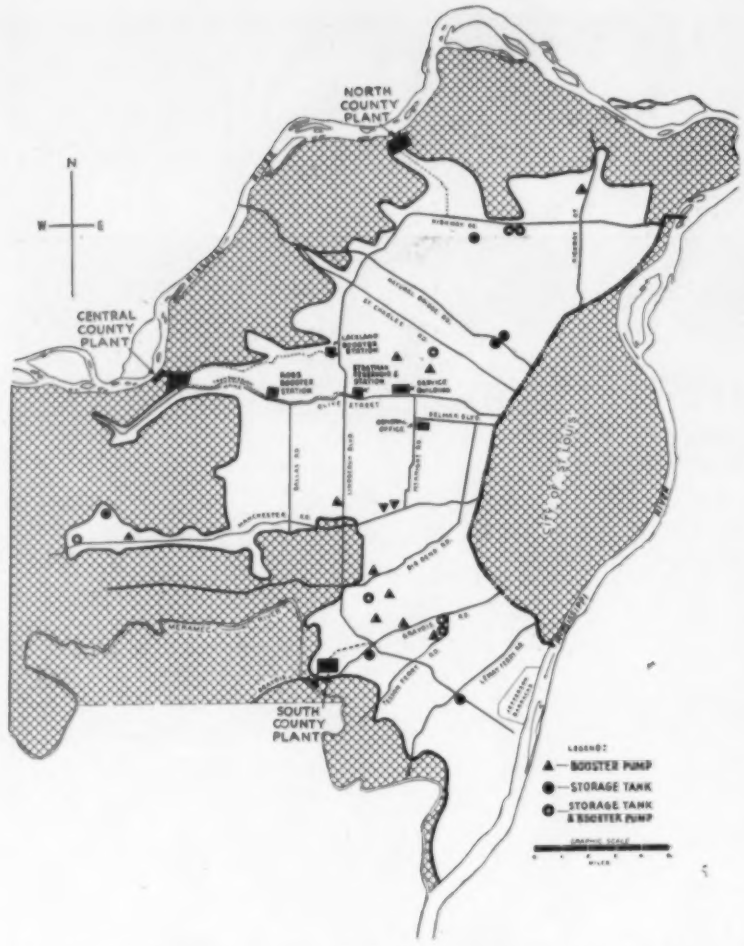
Mr. Dolson is Sup't. of Distribution for the St. Louis County Water Co., University City, Mo.

Here he tells something of what it is taking in facilities and money to keep his company's system ahead of the ever mounting water demands of modern living.

THE CAPRICIOUS MISSOURI River, the "Big Muddy," the Nation's longest river, flows enough water by St. Louis County in a single day to supply its needs for 2 years and 8 months. The Missouri is a dependable source of water supply. Its characteristics are such that, after proper treatment, it becomes a sparkling, clear water, relatively soft, palatable, and fine for all uses.

The story of the St. Louis County Water Company does not start with the River, but rather at the water's edge. It is a story of private enterprise acting with dispatch, of growth of area, of topography, and men and women who, in a short span of time, tripled the capacity of a water supply system to meet a situation never before encountered in its history.

In 1951, a year of normal weather, the maximum day pumpage was 41 million gallons, which was comfortably below the then available system capacity of 48 million gallons. In 1953, the maximum day climbed to



Pl. 2—MAP of area in white served by St. Louis County Water Co., showing locations of plants, pumping stations, tanks, etc. In the 210-sq mile area there are 330-ft differences in elevations and 78 customers to each mile of pipe

64 million gallons, but the system capacity by that time had been increased to 65 million gallons. Growth, air conditioning, weather, low water rates, freer use of water; all of these combined to cause a maximum day of 85 million gallons in 1954, but again expansion of capacity to 85 million gallons allowed the demand to be met, except for short periods when it was necessary to request customers to cooperate by not sprinkling during *peak* hour periods. By keeping the construction program in high gear, the system capacity will be increased to 136 million gallons by the early part of this summer, compared to an expected maximum day of 105 million gallons.

From a maximum day of 41 million gallons in 1951 to 105 million gallons in 1956; from a system capacity (. . purification, pumping, transmission and distribution . .) of 48 million gallons in 1951 to 136 million gallons in 1956, tells a story to anyone familiar with water systems. It tells a story of planning, engineering, construction, financing and hard work. It is a story of water works people, from the man in the field to the engineers responsible for design, who were confronted with a problem which they solved by dint of a cooperative effort and persistence.

The program took money—lots of it. In the past five years more than $21,000,000 was invested. This amount exceeds by 16 percent the total investment made by the Company in all of its previous history. And, another $5,000,000 will be required this year. If the County continues to grow as it has in past years, and if the per capita use of water steadily increases as it has been doing, annual expenditures of between 4 and 5 million dollars will be required to provide the additional water facilities that will be needed. As a matter of fact, Company planning is now based upon making an additional investment of 60 to 75 million dollars between now and 1970.

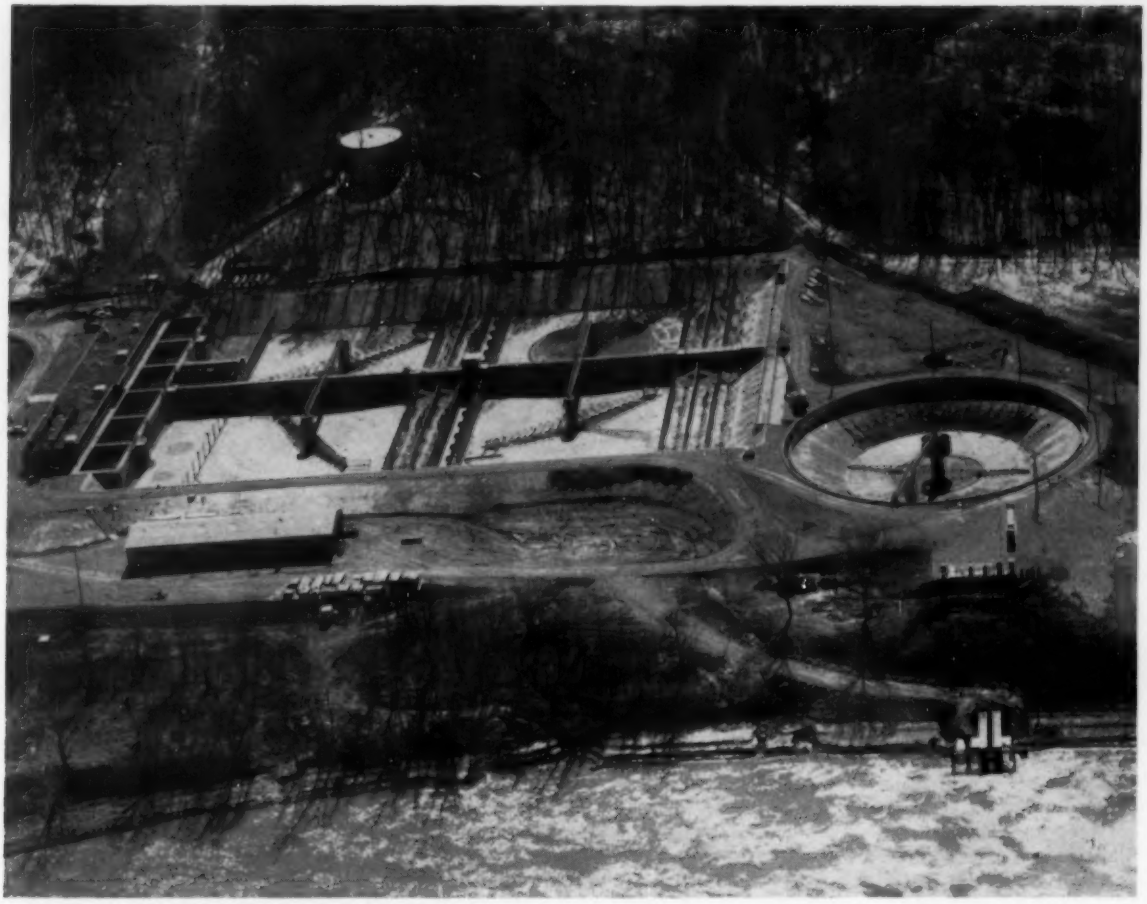
Metropolitan St. Louis is known for its "booze," shoes and good water. Not generally known is the fact that the St. Louis area, while not a leader, is only a step or two away in many other industries. Some of these are steel, railroads, chemicals, electrical equipment and metal fabrication. The industrial growth, while not spectacular, has been steady. The population growth has paralleled the industrial growth.

Area and Customers Served by the Company

The St. Louis County Water Company serves a crescent shaped area of about 210 square miles which surrounds the City of St. Louis on three of its four sides, as shown in the area map—(Pl. 2). Since the City of St. Louis is bounded on the east by the Mississippi River, it has a fixed area with very little ground remaining that is suitable for subdivision purposes. The service area of the Company is now about three times as big as that of the City of St. Louis and this ratio will probably become larger as subdividers, seeking cheaper real estate to develop, push beyond the flexible service limits. There is ample undeveloped ground available since the area of the entire county is more than 493 square miles. Semi-rural living, but with city utility service, is becoming more popular. Because of this, unsupported water lines of small diameter (6" and 8") are being extended along highways and roads leading in all directions. Ribbon type development is succeeded by small subdivisions, then larger ones, until finally reinforcing mains must now be laid, if satisfactory service is to be rendered.

The terrain of St. Louis County makes it desirable for both residential and commercial purposes. At the present time it is essentially residential, although considerable industry—most of it of the light type—has begun to move from crowded city quarters into more spacious surroundings.

Because there is little room in St. Louis for additional housing and since many workers employed in the heavy industrial area that is located across the Mississippi River (on the east side) prefer to live in the more



Pl. 3—NEW 36-mgd North County purification plant. River intake in lower right corner. 36-in. discharge main is laid uphill at 30° slope in loess-type soil

pleasant surroundings that are available in St. Louis County, most of the growth of the entire metropolitan area is locating in St. Louis County. Home construction in the County is about one percent of the national total compared with a population which is only one-third of one percent of the nation's total. Perhaps this can be emphasized by saying: In 1955 a new house was started in St. Louis County every ten minutes during the working day.

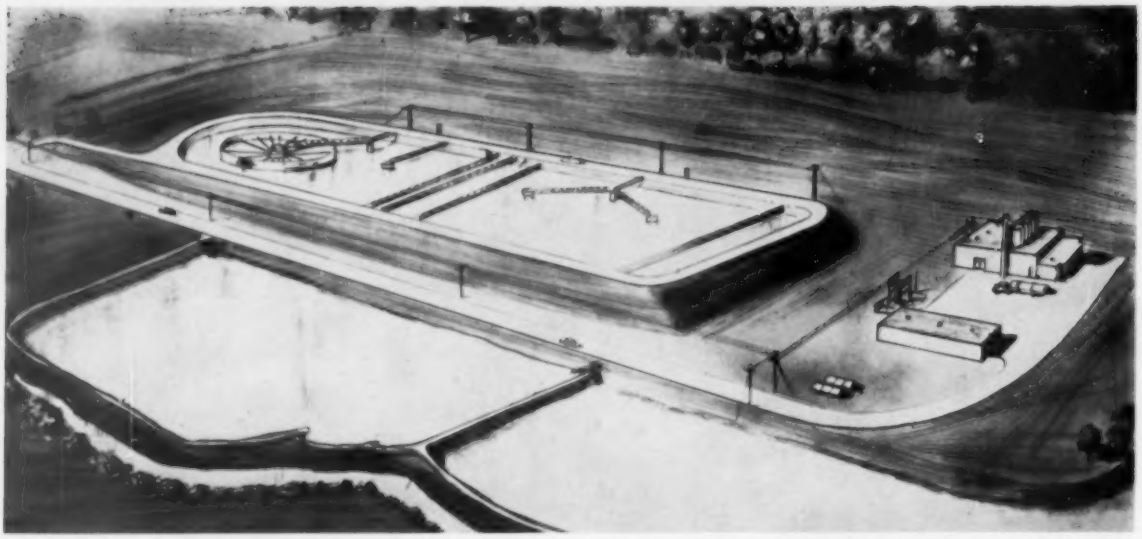
At the end of 1955 the Company served a total of 125,000 customers. However, three of these customers are actually cities, and another is a water district which also purchases water for resale. These customers—the cities of Webster Groves, Florissant, Kirkwood, and Water District No. 3, have 8500, 4800, 7500, and 1000 customers respectively—a total of 21,500. Florissant and Water District No. 3 receive their entire supply from the County system. Webster Groves receives 75 percent of its supply from the County system and about 25 percent from the City of St. Louis. The City of Kirkwood, under a special demand rate, uses the County system as a supplement when water demand exceeds its system capacity. Neglecting Kirkwood because only supplemental service is rendered, but adding Webster Groves, Florissant, and the Water District, gives the equivalent of 139,000 individual customers served by the County system.

New customers are being added to the County system at the rate of 10,000 per year. The wholesale customers are growing too. Taking this into consideration, it is estimated that approximately 12,000 new accounts are being added to the system yearly. There is no reason to believe that fewer will be added in this or the coming year.

Some Background

The Company was started in 1902. At that time it was known as the West St. Louis Water and Light Company. The plant was located on "Howard Bend" of the Missouri River and consisted of settling basins only and a red brick building for housing steam driven pumps. Water was pumped through a single 12" transmission main of considerable length to about 2,000 users. The system grew to 20,000 customers and an 8 million gallon per day plant in 1925, when a financial reorganization resulted in the foundation of a new company named the St. Louis County Water Company.

The new company enjoyed steady growth and by 1951 the system capacity had increased to 48 million gallons and the number of customers served to 91,000. The original plant, by extensive additions and modifica-



Pl. 4—NEW 15-mgd South County purification plant has several innovations. The novel submerged filters are located in rear end of settling basin

tions, had been converted into a modern one of high efficiency. All modern methods of water traetment were used. Steam, as a source of energy, had been replaced with purchased power. Diesel powered generators had been added as standby in case of power failure and, importantly, also for the purpose of reducing electrical demand charges. The original transmission main had been replaced with pipes of 20", 24", and 36" size. By the use of large booster pumps located near mid-point, the capacity of the transmission mains was increased from 36 million gallons to 49 million gallons per day. There were more than 1190 miles of pipe installed in the distribution system with balancing on-system storage located as required.

During 1952 it became apparent that a major expansion program would be needed if all requirements were to be met. Water demand for air conditioning was becoming a source of concern. Entire subdivisions were being constructed where each house was equipped with a non-conservation type air cooling unit. Super-imposed on top of this were unusual weather conditions with more than average temperatures and below normal rainfall. Unusual weather persisted through the summers of 1953 and 1954 to the extent that, within a short period of three years, there was a deficiency of more than a normal year's supply of rainfall.

Pl. 5—BOOSTER pump station for Lackland contains four 250-hp diesel powered pumps operated on remote control from Central Station

Pronounced Revision of Design Factors to Meet Modern Demands

These factors—growth, air conditioning, abnormal weather— coupled with increased per capita use of water, occasioned to a large extent by more water-using home appliances, pointed to the need for a pronounced revision in design criteria. As of today, an impressive 725 gallons per customer per day (maximum day) is the criteria now being used for plant design. Distribution system design is being based now on usage at the rate of 1250 gallons per customer per day during peak hours.

The expansion of facilities, as finally determined, encompassed all phases of operation. The following projects were designed and have been or will be completed by the early part of this summer:

(a) Raw water intake capacity at Central Purification Plant increased to 105 mg.

Pl. 6—NEW 36-mgd addition to the old 50-mgd Central County purification plant (left) to provide 86-mgd plant capacity

(b) Capacity of Central Purification Plant increased from 49 mg to a total of 85 mg.

(c) New North County Purification Plant, with a capacity of 36 mgd.

(d) New South County Purification Plant, with a capacity of 15 mgd.

(e) Three 2½ mg capacity, ground type, water storage tanks, each equipped with a pumping station having a capacity of 8 mgd.

(f) Two 1½ mg ground type storage tanks, each equipped with a pumping station having a capacity of 8 mgd.

(g) One 250,000 gallon elevated tank.

(h) One 38 mgd booster station.

(i) Three 8½ mgd, submersible type, booster pumps.

(j) 48 miles of transmission mains consisting of:
13 miles, 16″
11 miles, 20″
1 mile, 24″
9 miles, 30″
14 miles, 36″

(k) 355 miles of 6″, 8″ and 12″ distribution pipes

(l) 3100 new fire hydrants

(m) New General Office Building of contemporary design for accounting, commercial, and engineering departments and executive offices.

(n) Addition to maintenance and service building which more than doubles the garage, office, and work space.

(o) A company owned 2-way mobile radio system with units provided for all construction, maintenance, and service vehicles.

With these additions all components of the system have a daily capacity of 136 million gallons or more. The evening sprinkling load will no longer be troublesome because the system can handle peak hour flows of 225 million gallons. More than 1600 miles of pipe, 6″ to 36″ in size, are now being used to serve a population of about 550,000 people.

Space limitation does not allow a detailed description of all interesting facets of each of these projects. Some of them merit individual attention. Brief mention of the outstanding features of some of these additions will suffice for the purpose of this article.

The Central Plant

The 36 million gallon addition to the Central Plant (Pl. - and Pl. 6) involved all components associated with a modern water treatment plant, except units such as the wash water tank were not duplicated. The addition required two new intake pumps, paralleling preliminary and secondary flocculation and sedimentation basins, new filters and high service pumping equipment.

The new intakes are of the siphon well-type, remotely controlled from a panel located in the Central Plant control room, which is about 3,000 feet away.

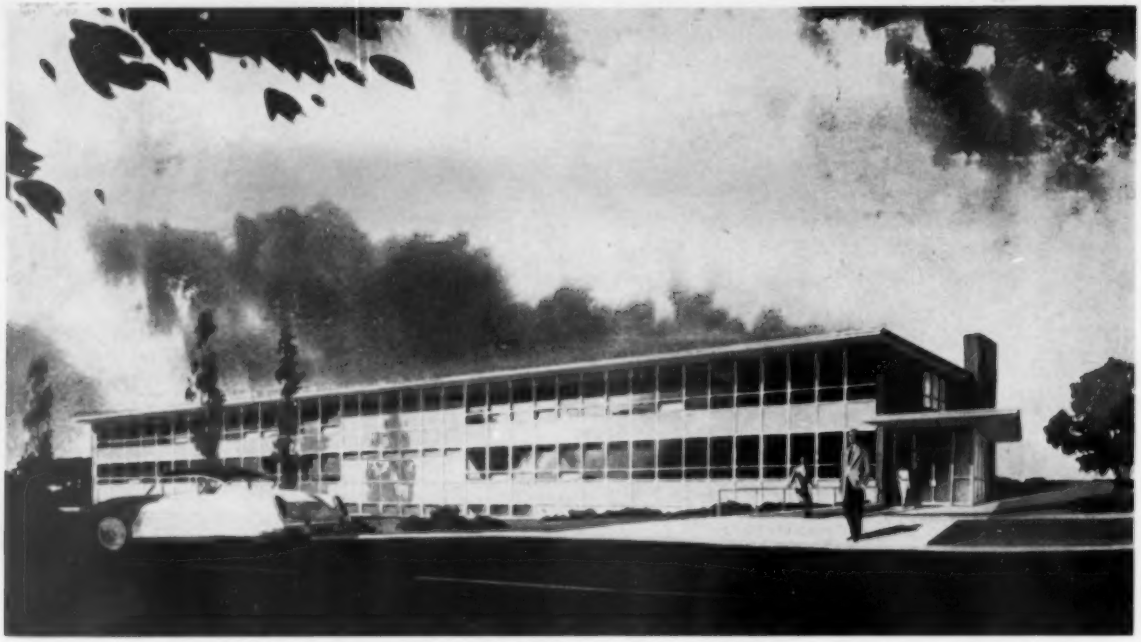
Because of the pre-filtration treatment facilities provided, filter design was on the basis of 4 gpm per square foot unit filtration rate. The clear well is under positive pressure with the maximum water elevation in it above the bottom of the filters. The rate of flow control valves serve only to *limit* the flow through the filters *to the maximum design rate*. Pneumatic industrial type control system was used. Butterfly valves, equipped with pneumatic positioners were installed on the filter effluent pipes for the dual purpose of flow control and tight shut-off. To save space, simplify design, and reduce building cost, the pipe gallery was located in the pumping station room.

Switchgear, pump controls, and recording instrumentation were located in the filter gallery opposite the filter controls in order to concentrate operations so that personnel could be reduced to a minimum.

The North County Plant

This new 36 million gallon plant (Pl. 3) is located on the Missouri River, 15 miles downstream from the Central Plant, and provides service to a section of the system which is growing at a rate faster than average.

The plant was conceived, designed, constructed, and placed in operation within a period of twelve months. It is located on a shelf of ground between the Missouri River on one side and a precipitous river bluff, formed by loess type soil, on the other.



Pl. 7—NEW General Office Building provides a needed 23,000 sq ft of area for executive, engineering, and commercial activities

Prefiltration treatment is of conventional design, consisting of presedimentation, primary and secondary flocculation, and sedimentation. Six filter units, designed for a 3 gpm per square foot unit filtration rate, are located outdoors adjacent to the pumping station. One of the six filters is provided with experimental suspended solids contact stabilization equipment for prevention of filter sand incrustation with calcium carbonate. The other filters will be similarly equipped if the experience with the one now being used proves satisfactory. Re-carbonation of the treated water is not practiced.

Raw water intake pumps, of the siphon well type, similar to those at the Central Plant, were installed in a single four-compartment box, which was sunk to proper depth by caisson methods, at a location immediately adjacent to the edge of the River. To secure proper siphon conditions, it was necessary to sink the bottom of the cutting edge of the box 70 feet below the ground line. The design of the box was an interesting problem in reinforced concrete design.

Several other facilities of this plant merit attention. The pumping station building design is modern, being of the contemporary industrial type, with a flat roof structure and no unnecessary ornamentation. High service pumps, chemical feed equipment, and pipe gallery are located in a large single space. Controls and recording instrumentation are located on several panels and a control table in a central control room. This allows all operations to be performed by a single operator and one assistant, aided during some periods by one or two other utility men.

The design here is on the basis of the high service pumps taking suction directly from the filter bottoms. No clear well, as usually conceived, is provided. As in the case of the Central Plant, pneumatically operated butterfly valves installed on the filter effluent lines serve only to limit the rate of flow through the filter to the maximum design rate.

The South County Plant

Construction on the new South County Plant (Pl. 4) will be nearing completion by the time this article is published. It will be operated shortly thereafter. There are many innovations in design, some of which might be considered radical. The description of these unusual features, such as the submerged filters etc., had best be deferred until experience with them under operating conditions is obtained.

The plant will be used only during summer months on a part-time basis, as required. Its design has been predicated on this consideration and all possible economies were effected.

It is located approximately 7,000 feet away from the Meramec River, from which raw water will be taken. The plant site is above the flood plain of the river, whose high and low stage may vary by as much as 35 feet in a single season. Because of extreme fluctuations of the river stage, submersible type intake pumps were installed in a reinforced, compartmented, concrete box located at the river's edge. These pumps, which will be remotely controlled from a panel board located in a control room at the plant, may be operated even though flooded by high river stages.

Booster Pumping and Surge Control

The addition to the enlarged Central Plant and the new North and South County Plants each is directly connected to the distribution system by newly installed transmission mains. 53,000 feet of 36", and 6,000 feet of 30" pre-stressed, steel cylinder concrete pipe, classes 100 to 200, were installed to connect the Central Plant addition to the distribution system. A booster pump (Pl. 5) with four 250 HP Diesel powered pumps has been installed near the midpoint of the pipeline (see Pl. 2) to increase its capacity to 36 million gallons per day. All operating functions, including pump starting, stopping, valve closures and openings, speed, temperature, and pressures are controlled or

Pl. 8—NEW addition to Service Building will more than double working space

recorded remotely on the Central County control panel board, located on the operating floor. All of this is made possible by the use of supervisory control equipment and leased telephone wires.

Because of the topography along the route of the pipeline, the velocity of flow at the design rate, and other features introduced by the booster station which was installed, special attention was given to the problem of water-hammer. Surge suppressors and slow-closing type air valves of proper size and number were installed where needed. Interlocks between the Central pumping station and the booster pumps were installed to protect the pipeline from abnormal pressures.

The new North County Plant feeds water directly into the system through a newly laid 36″ pre-stressed steel cylinder concrete transmission main, 22,000 feet long, connected into the third point of a 30″ cast iron pipe, 36,000 feet long, which was also a part of the piping project.

Because of close proximity of the load and the pumping heads selected, flow at the rate of 36 million gallons per day can easily be obtained through the 36″ leg of the pipeline system. Each leg of the 30″ cast iron pipe which completes the tie-in between the transmission main and the distribution system has a capacity of 20 million gallons per day. High flow velocities and topography again required careful consideration of the water hammer problem and the selection of proper equipment to protect the pipeline from surges.

Innovation in Pipe Jointing

One aspect of the construction methods employed in the installation of the 30″ cast iron portion of this project deserves special mention. The 30″ pipe was furnished with "roll-on" type joints in order to reduce excavated material handling to a minimum and because of special limitations imposed by the Highway Department relating to traffic and working space. The yarn and mastic material normally used in the roll-on joint were eliminated. In its place a poured slurry of Portland cement with Plaster of Paris additive was used as a backup for the rubber ring. This modified method of joining roll-on type pipe proved successful and was extremely economical. 36,000 feet of pipe was installed by this method with no leaks occurring under test pressures of 75 to 125 psi.

Pumping stations connected with ground type storage tanks have been made fully automatic. Time and pressure are the essence of the control scheme. Low water cut-off also has been provided to protect the pumps. A single butterfly valve, hydraulically operated, performs the three required functions of (1) control of system back pressure during tank fill cycle; (2) acts as altitude shut-off valve at end of fill period; (3) acts as check valve around which water is pumped during periods of usage from storage.

Centralized load dispatching was taken into consideration when control equipment was selected for these stations. Each station can be adapted with minimum trouble and expense to a centralized load dispatching system whenever the need for this type of operation becomes necessary.

The Multi-Pumping Picture

Elevations and distance are basic factors in providing water for St. Louis County. The service area is large with heavy concentration of population near the extremities. Terrain is gently rolling but with elevation differences of as much as 330 feet. In addition to pumps operated at the three plants, Ross and Lackland Boosters and Stratman reservoir, there may be as many as 32 other pumps in service at 16 different locations on days of high water usage. Some of these are boosters used to increase the flow through primary mains; others are pumping water from storage tanks to supplement the system.

New General Office Building

The new General Office Building (Pl. 7) was designed to meet the needs of the Company. It contains 23,000 square feet of usable floor space and provides for the requirements of all commercial operations associated with a water utility, as well as providing enlarged quarters for the Engineering Department and

Pl. 9—MOBILE 4-ton gantry in storage yard makes it possible for one man to load or unload any material in the yard. There is also a smaller 600-lb unit for light work

executive offices, and space for an employees' lunchroom and printing and duplicating.

It is modernistic in design with exterior walls constructed by the "thin skin" technique, using limestone for the spandrels with continuous window rows above. Vertical aluminum mullions are used between the windows for the purpose of giving the building a striking exterior appearance.

Equipmental features of the building include a dual type (regular and standby) heating system with five zone temperature control and dual type air conditioning with water conserved cooling tower equipment.

A short-wave radio console, located in the Engineering Department and directly connected by leased wires to the transmitter, allows the Engineering Department to be in direct contact with all company maintenance, construction, emergency, and service vehicles.

Enlarged Service Building

An addition to the Service Building (Pl. 8) more than doubles the garage and office space. It allows the expansion of the customers' service, maintenance, automotive repair, and meter repair departments. Vehicle storage area was also doubled in size. Space for a briefing room for construction and maintenance foremen and a meter-reading section has been added. Provision has been made for an employees' lunchroom.

The exterior wall section of the office addition was construction of thin aluminum sandwich-type panels, finished in a pleasing blue color. The garage building which has been added to the rear of the existing garage is of conventional design and has a storage capacity for 30 large trucking units.

Four of the offices within the building are air conditioned with a unit having water conservation equipment.

As was previously mentioned, the Company is now installing 120 miles of pipe per year. All of this work is being done by regular employees under the direction of the Engineering Department. All materials, including pipe, valves, fittings, and other items associated with this type of construction, are received, stored, and trucked away from a material storage yard, which is located immediately behind the Service Building.

Material Handling Equipment

The material handling equipment is of the mobile gantry type (Pl. 9). Two units of this type are in use. The larger one, which spans the spur track, has a capacity of four tons and a travel of 250 feet. By its use, pipe from rail cars may be unloaded directly to stock pile or trucks or loaded on to trucks from the stock piles.

The smaller unit has 600 lb. capacity with a travel of 250 feet. It is used for handling valves, fittings and fire hydrants which are stacked in parallel rows adjacent to the track on which it runs.

While not a part of the expansion program, it may be of interest to note that the Company operates a fleet of 87 automobiles and trucks which are maintained on a routine basis in a repair shop located in the Service Building. All construction, maintenance, and service trucks, and many of the cars provided to supervisors and engineers are equipped with two-way

Pl. 10—NERVE CENTER of Customer Accounting is this meter book rack containing 125,000 customer accounts

mobile radio units. Construction equipment of the most modern type, such as trenching machines, crane, rubber tired and crawler type high lifts, air compressors, etc., are also serviced and maintained by company employees at the garage shop.

Metering Practices

The system is almost 100 percent metered. A routine meter maintenance program is employed. Meters are changed at prescribed intervals or whenever registration reaches a fixed amount. Repaired meters must pass high test standards at a low rate before they are returned to service. Good meter maintenance practices, routinely performed, help the Company sell 89 to 90 percent of all water pumped.

Public Relations has received the attention it deserves. Year-End Review and Progress Reports have been mailed to each customer the past few years. In these reports, profusely illustrated with pictures and charts, features relating to water service such as surcharge for non-conserved air conditioning, good and bad lawn sprinkling habits, and the effect of sprinkling on the water system, facilities completed and under construction, future needs, etc., are discussed.

A booklet entitled "The Story of the Water Supply in St. Louis County" has been published and is available, free of charge, to school-age children and others who may be interested. Another booklet, written by an expert horticulturist, and entitled "Water for Beauty", describes the best methods of using water for lawns, trees, shrubs and gardens. Our objective—"To supply all water needed by St. Louis County water customers at the time they choose to use it" is a never-ending job but an exceedingly interesting one.

Harvard Research Team Gets Water Study Funds

A Harvard research team has received $150,000 for a three-year study of water resources development.

The project also will serve as a training ground for ten officials each year from such Government agencies as the Army Corps of Engineers, the Bureau of Reclamation, the Geological Survey, the Soil Conservation Service, the Public Health Service and the Weather Bureau.

The Graduate School of Public Administration will handle the project. The research team will be made up of engineers, economists and political scientists. The Rockefeller Foundation has provided the funds.

Two major river basins will be the basis of the research. They are the Delaware and Washita. The Delaware, covering 13,000 square miles, will provide data on a heavily populated, highly industrialized area. The Washita, 8,000 square miles in area, is sparsely populated and primarily agricultural territory in Oklahoma and Texas.

57-Year-Old Cast-Iron Pipe Looks Good As New

This 12-in. disc was cut from a 24-in. cast-iron main laid beneath Michigan Boulevard in Chicago in 1898 and replaced in 1955.

The appearance of the exterior of the pipe speaks for itself. On the interior there was some sparse tuberculation.

Ed. Note: This photograph was intended for use with the lead article in the April issue, by Dewey W. Johnson, dealing with water main replacements in Chicago, but was received too late for use with the article.

PIPE CLEANING machine being threaded into 36-in. nipple above ground with aid of special boom on fork lift truck

Reconditioning 36-In. Cast-Iron Trunk Mains at St. Louis, Mo.

by MEYER SERKES

Mr. Serkes is Division Engineer in Charge of Distribution, St. Louis Water Dept., St. Louis, Mo. In this article he describes cleaning and cement lining operations currently in progress to increase the flow capacities of large cast-iron mains in the high-value business district.

St. Louis is faced with the ever-present problem of a constantly increasing demand for water coupled with the decreasing available flow due to incrustation in old mains. This problem is being corrected by the cleaning of mains and lining them in place with a ¼-inch layer of cement.

At present, there is in progress work on a contract for 28,000 feet of 36-inch main to be cleaned and lined. This main, which was installed during 1894 and 1905, passes through the high-value business district of the city. The job was awarded to the Centriline Corp., which is a subsidiary of Raymond Concrete Pile Co., and the National Water Main Cleaning Co., doing the cleaning portion on this contract.

Many problems arise in the procedure of such work, such as, leaking valves, excessive cover, traffic hazards, utility obstructions, and the necessity of having certain sections in service while others are out of service. Leaking valves, ranging in size from 6 inches to 36 inches, constitute the most trying of all problems.

The incrustation encountered in the pipe is not very thick, but is extremely rough and hard. There were sections of the pipe which even after two cleaning shots still required considerable hand cleaning. The cleaning machine has been revised twice since the start of the job, the first revision being to shorten the cleaning machine, the second to increase the efficiency of the cleaning action by replacing the first row of flat scrapers with a row of stiff finger-like scrapers. The machine now has a row of finger scrapers, then four rows of flat scrapers, then a row of brushes.

Cleaned at Night

The cleaning operation is done at night when the discharge of water upon the street does not interrupt the flow of traffic as it would during the daytime. The cleaning machine is

either pushed through the main by water pressure from a valve in back of it, and the water flowing free from a planked hole at the exit, or the machine is drawn through the main by operating two 8-inch valves on a bulkhead placed on the exit end of the section to be cleaned. Two 8-inch steel pipes convey the water from these valves to the street surface, from where it is carried away by the storm sewer. This second method is used to obtain equal pressure on the large control valves, thus easing their operation.

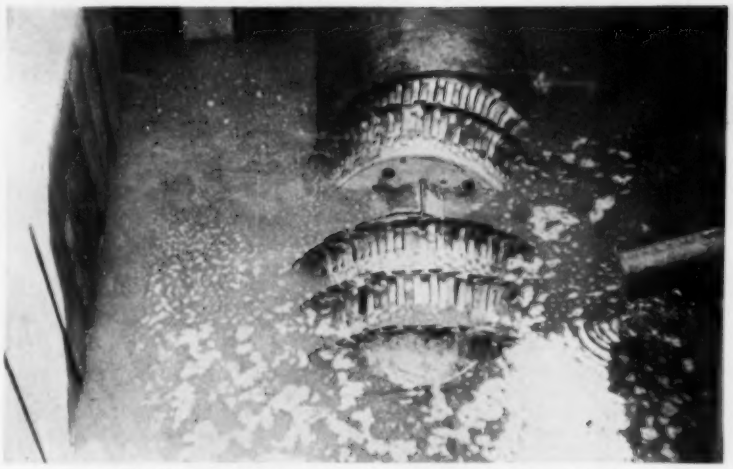
The bulkhead at the exit end is secured and blocked and the main is filled by small side valves. The large control valve, which could not have been operated before with the pressure on one side only, is then opened and the small valve used for filling is then closed. A two-way radio is left at the large valve with a crew of men, and the two 8-inch valves at the exit hole are opened to draw the machine through. A two-way radio accompanies the man following the cleaning machine so he can report to both ends the progress and speed of the cleaning machine. As the machine reaches the bulkhead, the 8-inch valves are shut off and the machine stops, the large control line valve is then closed and the main dewatered for the removal of the machine. The cleaning procedure is a highly synchronized operation which almost surely requires the use of two-way radio communication.

After the cleaning machine has been removed, an inspection of the inside of the pipe is made. Where hand cleaning is needed it is done. Or the cleaning machine may be run through again if needed. The machine travels through the pipe at about a steady walk, with as little stopping as possible. The machine very readily passed through a 60-degree wye and a long radius 90-degree curve on the short steel portion of this main.

Lining Procedure

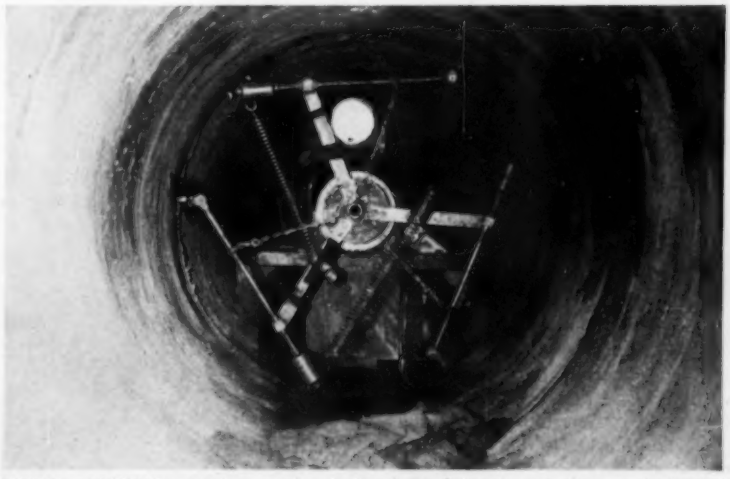
After the main has been thoroughly cleaned, the cement lining process begins. The large or deep joints of the bell-and-spigot pipe are filled flush with grout. The cement lining machine then enters the pipe and starts its crawl out of the pipe, installing a smooth troweled coating of sand and cement mortar one-quarter inch thick. This coating is made up of one part cement to one and a half parts of sand by volume. One part of natural cement to five parts of Portland cement by volume is used.

The electrically driven lining machine deposits the cement mortar on



CLEANING MACHINE emerging from main at end of work section

"SPEED BUGGY" used originally for transporting mortar to the lining machine. This was later replaced by small hand pushed buggies



LINING MACHINE, showing round spinning head (center) and three spring-loaded finishing trowels

FINAL JOINT in nipple replacement is made with 36-in. Dresser coupling and coated with Bitumastic paint. Backfilled hole is then capped with temporary asphalt topping for 60 days before permanent repair is made by street department

the interior surface of the pipe by centrifugal force, resulting from the rotation of a dispensing head at approximately 1,000 rpm. A feed screw forces mortar into the dispensing head, which has slots and toothed vanes around the periphery from which the mortar is thrown as a fine spray on the walls of the pipe. The mortar is mixed in a special truck at the entrance of the pipe opening and delivered to the lining machine by a special electrically driven "Speed Buggy", or in this case, due to slope and vertical curves, by a series of small hand pushed mortar buggies.

The thickness of the lining, which in this case was ¼-inch, is determined by the speed of travel of the lining machine through the pipe. After its deposition on the interior of the pipe, the mortar is smoothed and finished to a almost glassy surface by three rotating trowels attached to the head of the machine. The machine backs away from the finished portion of the work during the lining procedure.

After the coating has hardened sufficiently, a finisher enters the pipe and patches by hand any irregularities or faults that can be observed, after which some water is admitted into the pipe and all manholes and openings are closed, in order to keep the humidity as high as possible while the mortar is curing.

After the mortar lining has cured sufficiently, the section of pipe is filled with water, kept under zero pressure, and chlorinated. The chlorinated water is left in the main for at least 24 hours. The main is then drained, refilled, flushed with fresh water, and placed back into regular service.

The cement lining of the interior of the pipe not only prevents the formation of incrustation, but also eliminates possible joint leakage, as the compressive strength of this cement mortar averages 5,000 pounds per square inch.

The "C" value of the pipe prior to cleaning had dropped to an average of 74 (William-Hazen). After cleaning and lining, a "C" value of about 140 is obtained, which is better than the value given for newly installed pipe.

The contractor on this job furnishes all material and labor for all operations except the operation of city valves and the chlorinating of the main upon completion. All other work, as well as the necessary two-way communication system, is set up and furnished by the contractor.

Personnel

The Centriline Corporation is represented by Charles Erskine and Ozzie Finders; the National Water Main Cleaning Company is represented by Joe Fielder. Resident Engineer for the city is Robert Easterday. The author is Division Engineer, Distribution Section. Thomas J. Skinker is Water Commissioner.

Plastic Tubing Gets Clean Bill of Health

In a paper read before the American Society of Civil Engineers in Dallas, Tex., Walter D. Tiedeman, Director of the National Sanitation Foundation, Ann Arbor, Mich., reported on a three-year study of the safety or toxicity of plastic pipe and tubing offered for use in water supply systems.

The three-year study, said Mr. Tiedeman, had shown that the plastic tubings tested had in no way affected color, odor, or taste of the water. In addition, no toxic substances had come from water standing in the plastic tubings, nor had there been any attack of the plastic by chemicals commonly added to potable waters.

As to attack on plastic tubings by rats, the only time rats gnawed the material was when it was placed between a food supply and the rodent. Rats showed no interest in the plastics as food or even as a chewing material.

Mr. Tiedeman reported that the Foundation is developing a stamp of approval (a hall-mark) to be imprinted in plastics found to be satisfactory for conveying drinking water.

Fluoridation's 10-Year Record Reported by A.D.A.

Four American cities have now been practicing water fluoridation for 10 years. These cities are Grand Rapids, Mich.; Newburgh, N. Y.; Sheboygan, Wis.; and Brantford, Ont.

In a review of results from fluoridation, the Journal of the American Dental Association reports that the records show a 60 per cent reduction in tooth decay among those children which have had nothing but fluoridated water since birth. There have been "no signs of any detrimental effects" on this group of children, according to the A.D.A. Journal.

The Journal further states that increasing reports from other communities and numerous studies continue to "augment the mass of scientific evidence" on fluoridation's effectiveness, safety and economy. Thereby, this method of tooth protection has passed from the status of theory to that of "scientific law."

Modernized Meter Reading

by PAUL WEIR

Mr. Weir, General Manager of the Atlanta, Ga., Water Works, is President-Elect of the American Water Works Association. In this article he describes the means evolved for covering outlying meter routes efficiently.

ON JANUARY 1, 1952, the corporate limits of the City of Atlanta were extended from 37 to almost 130 sq mi. Portions of the newly annexed area had been previously serviced with water from the Atlanta system, but many wells also served this area.

A five-year expansion program, now in its last year, was instituted to extend water service to the new area. But one of the most difficult jobs encountered dealt with the monthly meter reading of some 110,000 accounts. Most of the zones in the original city area were read by meter readers on foot, but the expanded limits made it necessary to motorize many of the new routes. About 15 meter readers daily read between 300 and 450 meters each.

The expanded areas brought on an entirely new problem: scattered surburban homes on large lots, and the greater distances between meters. The meters are set as near as possible to the curb line in front of the location to be served, but the net walking distance of the new routes was still increased from two to three times the former ones.

A committee headed by T.H. Bird, the Office Manager, was formed to investigate and recommend improved procedures for handling these routes. Large dairy firms who had the problem of delivering milk in many of the same areas were contacted, but the stand-up type dairy or delivery truck did not lend itself to our needs. Specifically, the hazard of the driver being thrown out of the truck should it hit an obstacle while the operator drove in a standing position did not meet our safety requirements. We next considered removing doors from a ½-ton truck and placing a long safety handle or bracket at the point where the door was previously hinged. This helped somewhat, but still did not reduce the time consumed in entering and leaving the truck when reading the meter. It was next decided to use fluid transmission ½-ton pick-up trucks. This arrangement materially reduced the operating costs, repairs on the clutch, brake, etc., but still did not entirely eliminate the human problem.

In the old days, the inspectors used to ride motorcycles. The "new look" for this type of transportation has been satisfied by the motor scooter. This equipment was carefully investigated, but it did not suit the purpose either. It was not an all-weather vehicle, and every time the operator read a meter the motor scooter had to be parked.

Then a three-wheeled all-weather motor scooter was discovered. This equipment was borrowed for demonstration, and proved so successful that two units were purchased. Others will probably be added to the fleet each year, since about one-half of the routes are now motorized.

Some of the outstanding features of the three-wheeled motor scooter (see photograph) are as follows: It has a small enclosed cab on a three-wheeled chassis. This cab affords all-weather protection to the meter reader and the rear compartment enables him to carry an additional meter reading stick and other equipment to clean out meter boxes.

The scooter is painted in Atlanta Water Works' contrasting colors (blue and white with red wheels) affording the operator greater protection from passing traffic. It has the same gear shift as a car and the clutch is of a type that makes it possible to leave the vehicle in gear and put on the emergency brake while reading the meter. To proceed, the emergency brake is released and gas is fed to the unit.

The motor scooter can be mounted or dismounted from either side without opening a door or stepping up or down. It has a 5-hp motor, giving a top speed of 35 mph and about 50 miles to the gallon of gas. It is manufactured by the Cushman Motor Scooter Company.

THREE-WHEELED motor scooter simplifies curb meter reading

TYPICAL pipe cutting jobs with the new cutting machine

Cutting Large Diameter Cast-Iron Pipe

What the Portland Water District has learned about the old and the new methods

by J. P. HENNINGS

Mr. Hennings is Superintendent of the Portland Water District, Portland, Me. He tells of how quickly the use of modern pipe cutting machines has made pipe cutting with cold-cutters and diamond points archaic in Portland.

ONLY THE OTHER DAY, with pipe to cut—too much pipe to cut—a foreman reported that our pipe cutting machines were both busy. The suggested solution was to cut it with diamond points—as of "yesterday."

Only a very few years ago this situation could not have existed; the cutting would have been done by diamond point and no questions asked. Subsequent to that period was the era during which the foreman's cry was "We don't want that new fangled machine, we can do the job quicker with diamond points." The other day, just with the suggestion of "diamond pointing" the reaction was quick and emphatic: "That's a lot of work! It'll take all day!"

The cutting of large-diameter cast-iron pipe has, until recently, been one of the most unsatisfactory operations in the construction and repair of water mains. Here in Portland, considerable thought and a good deal of money has been spent in recent years with a view to improving this situation. We have now arrived at the point where nearly all cuts, both in the ditch and on top of the ground, are made with pipe cutting machines. We feel it is far safer than either cold cutters or use of the "diamond-point-and-bust-out-with-a-sledge" method. Time consumed is short, and when you get done you have cast-iron pipe left, not scrap iron.

On the smaller sizes (2 in. through 12 in.) either knife-type ratchet cutters or wheel-type cutters are used, with more of the knife-type being used on the 8 in. to 12 in. pipe. On the 2 in. cast-iron pipe cutting is done with a regular three-wheel cutter. But when it comes to cutting the larger sizes of pipe we really go overboard. We bought a pipe cutting machine a couple of years ago and found that it cuts pipe above ground or underground or almost anywhere you can find about 18 inches clear along the pipe and you can get about 18 inches of hole around the pipe. The one machine cuts all sizes from 10 in. to 48 in., inclusive.

Of course, it is understandable that we didn't just up and buy this machine without considerable meditation and soul-searching, not to mention more practical considerations (such as justifying the expenditure to the Trustees of the District) after demonstrations had indicated the desirability of ownership of the machine.

It came about this way: we had quite a number of cuts to make in connecting the new Sebago Lake intake into the existing system. Space and time were limited. Shut-downs could be made only on Saturday nights, so 30 in. and 42 in. fittings had to be done literally "overnight." Both limited space and time seemed to make hand cutting impossible.

We heard of a machine that would cut pipe at the rate of one minute per inch of diameter, but we didn't have a machine and we weren't sure enough that it would do all that was claimed for it to venture the seemingly high investment. Water works men all know how it is. Often you have to

make a shutoff and do a job, although you can't be 100 per cent certain as to how long it will take or just how it will go together. You just hope and pray it will. We all worry about ordinary shut-downs. But when we had to shut down the only supply line to a community of 150,000, without being sure as to the success of the cutting method, or of the time necessary for the work, we nearly had nervous prostration worrying about it. And, frankly, we didn't take too much stock in this one-minute-per-inch-diameter cutting rate which was claimed.

NEW pipe cutting machine being given a yard trial

So, We Just Rented A Machine

Imagine cutting 42 in. pipe in 42 minutes! But we had to go ahead—and hope. So, we arranged to rent a machine at the rate of one dollar per inch of cut. We found that it did not cut 42 in. pipe in as short a time as 42 minutes—it took almost 45 minutes! With the rented machine we got the cuts made and the new connections finished in plenty of time.

We had made several 42 in. cuts and some 30 in. ones before we got the machine rental bill. The bill appeared to be something over three times what we had expected. It seemed that we had figured on paying per inch diameter cut and the bill was figured on the basis of inches of circumference! This must have been in the fine print somewhere.

At this point it became apparent that it would be quite worth-while to actually own a cutting machine. So, we bought our first machine in December 1952. Since then here is a summary of the cuts made with our own machine in the first three years:

Pipe	*Cuts*	*Pipe*	*Cuts*
12 in.	7	30 in.	16
16 in.	17	36 in.	7
20 in.	33	42 in.	32
24 in.	17	48 in.	8

Figuring the rental cost of a machine to make all these cuts, even using the pipe diameter instead of circumference, it comes out to almost $3,700. This is more than the cost of the machine, in only three years. Figured on the basis of circumference we could have saved by buying three machines.

Soon Found Ourselves Owning Two Machines

After three years of very satisfactory operation of the Wach's "Pipe Saw" we have recently purchased a second machine. The new one is a German-made machine, now sold in this country. Both machines operate on the same general principle. The German machine is, however, much lighter in weight, eliminating the use of hoisting apparatus, as two men can easily set it on the pipe or remove it. Both machines are powered by air motor. Both crawl around the pipe, while a small circular saw cuts through the pipe wall in a single pass around the pipe. One possibility of trouble with both machines is the likelihood that, upon travelling the circumference of the pipe, the machine may not return to exactly the original point of beginning. This is readily avoided, however, if reasonable precautions are taken.

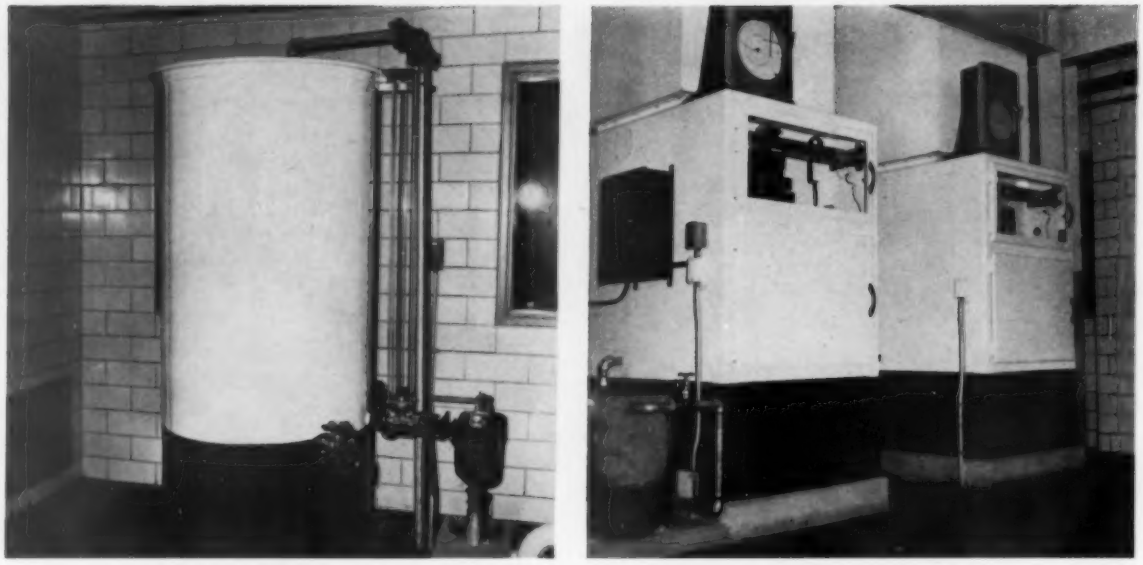
Since all new cast-iron pipe laid in Portland is cement lined, all saw blades are bought with carbide tips. Many cuts are made before blades must be re-sharpened. Cost of sharpening is small; and, barring accidents, is very infrequent.

As in cold-cutting, the pipe should be well blocked on both sides of the cut to support it. Also, it is important that the wedges furnished be inserted in the saw kerf to eliminate binding. This is particularly true if carbide tipped blades are used, as binding will lift the carbide inserts right out of the blade. Particular care must be taken as the cut is being completed. to see that the severed pipe does not kick and bind the saw or even harm the machine itself.

With these few precautions, the two "pipe saws" have proven extremely satisfactory. Among the advantages are sure-fire quick cuts, accurate cuts to exact length, safe cuts, no cracked pipe, simple to operate almost anywhere, and the easiest pipe cutting yet. As mentioned before, the cost of the machines is easily justified if any cutting of large pipe is to be done. Added to this are further benefits arising from cutting down of labor cost and the minimizing of the spoilage of pipe.

So, in Portland you have to dig deep to find the old cold cutters and then you are faced with the problem of finding anyone to use them. This is what you hear: "Let's wait until the machine gets back from the other job!"

SETTING and adjusting the machine—then, a minute of operation per inch of diameter and the job's done



CHEMICAL FEEDERS: One-day liquid alum tank and solution feed control (left); Omega dry feeders (right). The near unit is used as a Bentonite clay feeder—note improvised clay suspension box

Bentonite Clay As A Coagulant Aid in Gary

Increased Filter Runs a Noteworthy Gain

by LEO LOUIS

Mr. Louis is Vice-President and General Manager of the Gary-Hobart Water Corp., Gary, Indiana. In this article he describes the advantages of using Bentonite clay in coagulation of Lake Michigan water containing algae.

THE FILTRATION PLANT of the Gary-Hobart Water Corporation in Gary, Indiana, is one of the newest in the state, having been placed in operation in May 1954. Gary's raw water supply, from Lake Michigan, is relatively good when compared with other Lake Michigan supplies. In fact, the first 46 years of its history the Gary water supply was chlorinated lake water, without benefit of coagulation, settling, or filtration.

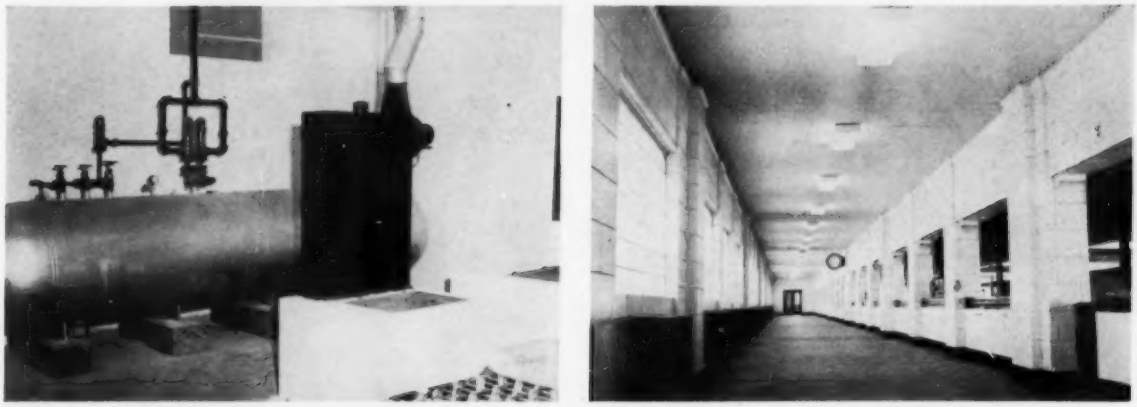
Customer complaints of turbid water after storms over the lake increased through the years with Gary's growth, and plans for a filtration plant were developed by Alvord, Burdick and Howson, consulting engineers, Chicago, in the late 1940's for the then owners, Northern Indiana Public Service Company. These plans were delayed by the decision of that owner to sell all water property, which sale was consummated in May 1951. The newly organized company, Gary-Hobart Water Corporation, asked the same consulting firm to proceed with the design of the plant and in 1952 began the construction of the new treatment facilities. Incidentally, the engineering firm of Alvord and Burdick had laid out the original water system for the first Gary water supply in 1906-08.

The new filtration plant was placed in operation on May 1, 1954, the third anniversary of the new company. Design of the plant is conventional for Lake Michigan water. However, there are several notable exceptions to the strictly conventional design. These are:

1—The six rapid sand filters were designed for a 36-mgd total capacity at a rate of 2 gallons per square foot per minute, but can be operated at a 3-gallon or 4-gallon rate to increase the capacity to 54 mgd or 72 mgd. Peak hour filter rates during the 1955 summer months were often above 54 mgd and approached 60 mgd.

2—The settling basins are two stories in height, with the water passing through the lower basin, thence upward and reverse through the upper basin (see drawing).

3— The mixing basins are at the same



AMMONIA STORAGE tank and charging floor for dry feeders (left); filter operating floor (right)

level with the upper settling basins and are equipped with mechanical revolving paddle flocculators. One of these mixing basins is located immediately below the general business office of the company.

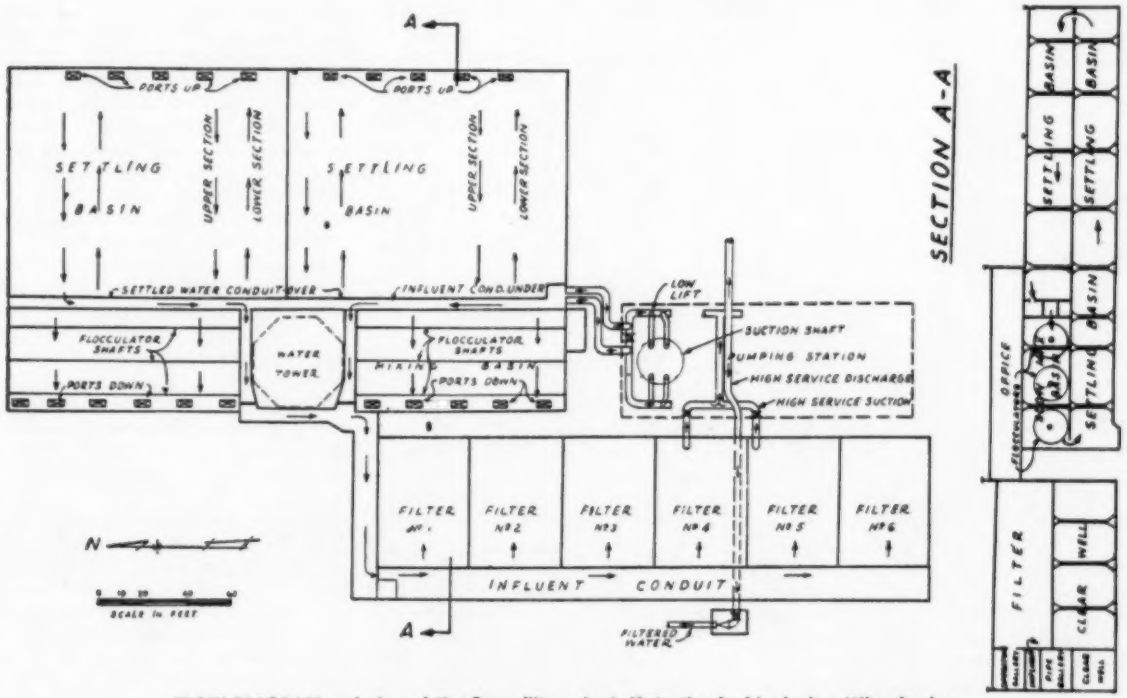
4—Because of the absence of a railroad siding at the plant site, liquid chemicals are utilized as much as possible to eliminate handling of dry chemicals. In addition to ton containers of liquid chlorine, liquid ammonia is delivered by truck and stored in a large steel storage tank, and liquid alum is generally used as a coagulant. This plant was probably the first municipal water plant to utilize liquid alum delivered by tank truck directly from the supplier's plant to the filtration plant.

The Algae— Short Filter Run Problem

As a part of coagulation, a problem arises in Gary during the summer months when algae counts are high in the clear raw lake water and the algae become difficult to settle before filtration. The dead algae cells tend to clog the filters and reduce filter runs tremendously. This condition becomes most serious at a water temperature of approximately 60° F in the early summer and again in the fall.

In 1954, during the first summer's operation of the filtration plant, filter runs dropped to 4 hours or less and ordinary coagulation aids such as lime did not seem to help the situation. The turbidity of the raw water was extremely low and good floc formation was difficult. Algae identification pointed to asterionella, fragillaria and tabellaria as the cause of the shortened filter runs and high wash water consumption.

The plant chemist made inquiries of other filtration plants using Lake Michigan water and found that this condition was the same and equally



FLOW DIAGRAM and plan of the Gary filter plant. Note the double-deck settling basins

PUMPS AND LABORATORY: Three raw water pumps in well beyond two high service pumps

serious at most of the plants along the lake. He found that Wilmette, Illinois, had been experimenting both on a laboratory and a plant basis with Bentonite clay and had considerable success with it in weighting the algae-laden floc and assisting in settling. We arranged to borrow 4 tons of the material from Wilmette and experimented with it ourselves. On the basis of those experiments we and the Michigan City Water Department jointly bought a carload of the bagged clay.

The results were good enough in 1954 to warrant the purchase of another carload in 1955. The Bentonite clay is shipped in 100-pound multiwall paper bags and stored with the other bagged chemicals. It is fed through an Omega loss-in-weight gravimetric dry feeder ordinarily used for lime. The measured clay is mixed with water in a stainless steel solution box and pumped as a suspension to the raw water suction well. There has been little trouble in feeding the material.

According to information furnished by the manufacturer's agent, this material is produced by the American Colloid Company in two grades. One is Panther Creek Bentonite, which has its source in Aberdeen, Mississippi. The other is Volclay KWK, which comes from Belle Fourche, South Dakota. Panther Creek Bentonite is a light gray-tan powder, which when placed in water swells to three times its dry volume, where Volclay KWK is a cream-colored pelletized material which swells to ten times its dry volume.

The American Colloid Company, in their data sheet No. 200-A, explain further that Bentonite as produced by their plants includes only swelling montmorillonite type clay. The greater swelling Bentonites are used primarily in foundry molding processes and for use as drilling mud in the oil fields. It is also used as a detergent in commercial laundries.

The use of Bentonite as a coagulant aid in water treatment embraces its value not only as an artifcial turbidity producing material, but also as an adsorptive material with negative charges which attract the floc particles in the water and by absorption form larger heavier particles which will settle effectively.

The manufacturer's representative comments that while Volclay should give better efficiency in increasing turbidity and in picking up and holding bodies which may be causing short filter runs, the high swelling ability also causes it to be somewhat difficult to handle. Sheboygan, Wisconsin, and Wilmette and Winnetka, Illinois have all tried both type of clay; of the three cities, only Winnetka prefers Volclay. We have never tried Volclay or experimented with it and our expreiences have been solely with Panther Creek Bentonite.

Some of Our Experiences

Our experiences with Bentonite, both in 1954 and in 1955, demonstrated that the use of the material resulted in lengthened filter runs, although it is possible that other factors could have contributed to the change in filter performance.

In the latter part of June 1954, the length of filter runs dropped off from a minimum of 18 hours on June 14 to 4 hours from June 16 through June 19. On June 18 we had 19 filter washes. Some of these were only of 1-minute duration instead of the usual 4 minutes, but in addition we had to "bump" the filters frequently between washes. The condition was better on June 20, but became worse again on the following day with filter runs as low as 2 hours being recorded on June 25. On that day 21 filter washes were made, with additional filter "bumps".

Our average use of wash water is less than 2.5 per cent of the total water pumped through the plant, but during this period it averaged between 4 and 5 per cent. Pumpage and filter rates were higher than normal during this period and on June 25 the maximum hourly total filter rate was 56 mgd. Raw water turbidities were less than 10 ppm and algae counts were apparently high, although unforunately we do not have any record of these data. The total pumpage on June 25 reached a new record day of more than 38 million gallons, filter rates were over 3 gallons per square foot per minute, and with the 2-hour runs we were definitely in trouble. Continued "bumping" of the filters and short washes didn't help too much. Consequently, that day we sent a truck to Wilmette and borrowed 8,000 pounds of Bentonite.

On June 26 we started feeding the clay at a rate of 32 pounds per million gallons and on that day our filter runs lengthened to between 10 and 12 hours. On the 27th they increased again with the same feed rate and on June 28 we increased the feed rate to 40 pounds per million gallons. We have since used the 40-pound rate as the optimum feed. From June 27 until July 6 the filter runs gradually increased to an average of 50 to 60 hours. On June 29, however, we had 16 filter washes for some reason,

possibly because of a very high total filter rate on that day. Feeding of the clay had to be discontinued on July 7 because we had used up all of the material on hand. We had ordered a carload meanwhile, but this didn't arrive until July 13. On July 10 the runs had decreased to 31 hours and by July 13 we were down to 3 hours.

Late on that day we started feeding Bentonite again and by the next day we were back to runs of more than 10 hours. Bentonite was continued until July 26 and filter runs were maintained at normal levels with the exception of July 19 and 20, when again a high filter rate apparently caused more filter washes. This was during the peak pumping season and filter rates were quite often as high as 3 gallons per square foot per minute during this period.

In 1955, Bentonite was fed for a few days during the latter part of June and from July 6 to 25. The experience was about the same as in 1954. On June 21 the wash water use was 4 per cent of total pumpage with no clay; with two days of clay fed at a rate of 40 pounds per million gallons wash water use dropped to 1.3 per cent. On July 5, the wash water use was over 5 per cent and after clay feed was again started wash water use dropped to below 2 per cent.

It is difficult to state conclusively that the Bentonite was alone instrumental in increasing filter runs during these periods, as graphs indicate that filter rates fluctuated somewhat parallel to the filter wash water usage and filter runs. Nevertheless, the use of clay tended to keep water use at a lower level regardless of the filter rates. It is also true that our story isn't entirely complete due to the lack of data on algae counts. However, our plant personnel definitely feel that Bentonite clay contributed a great deal to better operation during these periods of high filter rates, when every drop of water that can be pumped into the system counts a great deal and having to shut down a filter for washing or having to rob the distribution system for filling the wash water tank presents many problems.

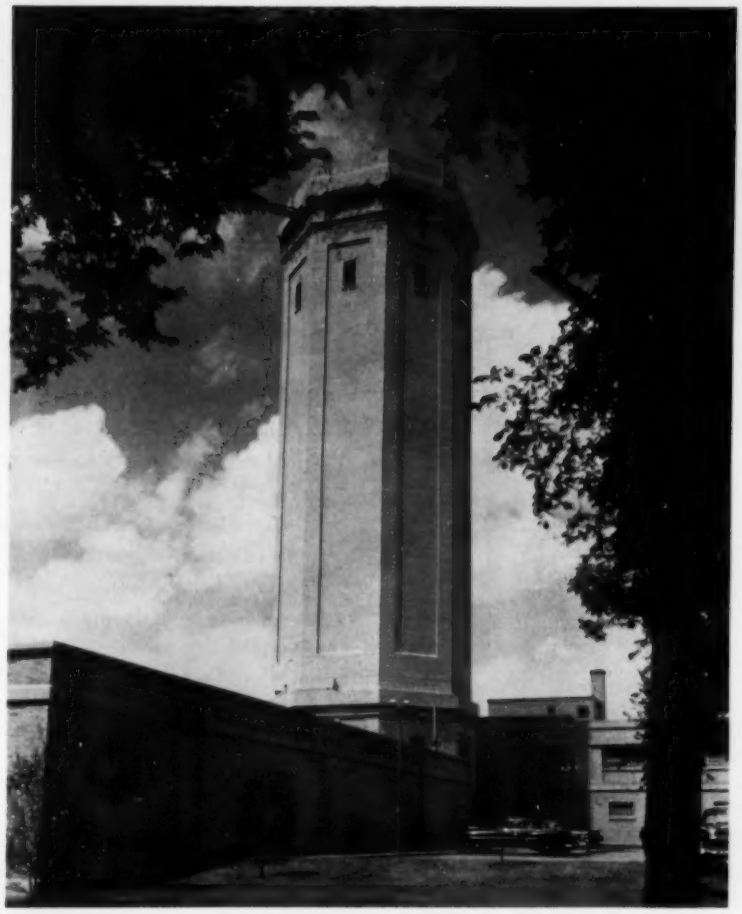
Aside from the more efficient operation resulting from the better coagulation, there could be a definite monetary savings if less wash water is used.

Costs and Savings

Panther Creek Bentonite costs us approximately $1.55 per 100 pounds FOB Gary in a 30-ton carload lot. Based on a feed rate of 40 pounds per million gallons, the additional cost of clay is approximately $0.62 per million gallons. The maximum pumpage day last year was 42 million gallons and if on that day we were able to reduce the number of washes from 21 to 8, as occurred when we first started feeding clay, we would save 13 washes at 130,000 gallons each, or a total of 1,690,000 gallons of water. Actually, some of the 21 washes were only of 1-minute duration rather than 4 minutes long, so the wash water savings would be closer to 1,000,000 gallons on that day. Our average purification and pumping cost at the main plant was approximately $30 per million gallons in 1955, so the savings on wash water for a day would be $30. The cost of Bentonite clay on the 42-mg day would be 42 x $0.62 = $26.04, or a little less than the cost of the extra water used in washing.

It is difficult to determine actual savings from plant records, as there are so many factors involved (such as day-to-day pumpage fluctuations, different filter rates during the night and day hours, and the habits of filter operators as to exactly when they might want to or be able to wash filters from one day to the next). The only way to obtain exact figures on this would be if parallel operation of two sections of a plant would be possible—one with Bentonite and one without. This would eliminate variables in the quality of the water during the test period.

In conclusion, the use of Bentonite clay as a coagulant aid in Lake Michigan water during periods of low turbidity in the presence of certain algae growths and while plant pumpages are high, appears to be conducive to extending filter runs with the consequent saving of wash water. Above the economy of wash water saved, however, is the advantage of not having to take filters out of operation so many times and not having to drop system pressure to fill the wash tank at frequent intervals.



FILTRATION PLANT built around original stand pipe, now brick encased for appearance sake and used as a wash water tank

Bettman Archive

Notes on Water Works Law

by JOHN H. MURDOCH, JR.

Mr. Murdoch is Vice-President of American Water Works Co., Inc., and Chief Counsel of American Water Works Service Co., Inc., Philadelphia, Pa. He has prepared exclusively for *Water & Sewage Works* this series of articles discussing water works law as it applies to source of supply, water quality, and water distribution.

Eighth Installment—Liability for Flooding from Mains and Services

Review

In the fifth and sixth installments of these Notes water works liability for furnishing water dangerous to health was the subject. In the fifth installment it was brought out that there is no distinction between privately and publicly owned water systems as to liability for the acts or failures to act on the part of officers or employees. It was stated that the courts hold that *when a municipality undertakes to supply water for commercial, domestic and industrial purposes, it acts in its proprietory capacity rather than in its governmental capacity and that, in its proprietory capacity, it is liable for acts or failures of its servants, just as a privately owned water company would be liable.*

In that same installment definitions of terms and some legal principles relating to the law of negligence were stated. As liability for flooding is usually determined under the law of negligence, a short review of those definitions and principles seems to be needed.

Negligence is the failure to observe for the protection of the interests of another person, that degree of care, precaution, and diligence which circumstances justly demand, whereby such other person suffers injury. Or it is any conduct which falls below the standard established by law for the protection of others against unreasonable risk of harm.

Standard of conduct established by law is that of a *reasonable man* under like circumstances.

Reasonable man is a person exercising those qualities of attention, knowledge, intelligence and judgement which society requires of its members for the protection of their own interests and the interests of others. The opinion was expressed that, in water works law cases, "reasonable man" would be held to mean a well-trained water works man.

Unreasonable risk is one which outweighs the value of the conduct which involves it.

Negligent conduct may be either (a) an act which the actor as a reasonable man should realize involves an unreasonable risk of causing an invasion of an interest of another, or (b) a failure to do an act which is necessary for the protection or assistance of another and which the actor is under a duty to do.

Before there is a legal liability for damages in negligence cases, seven elements must be present. They are:

First, damage must have been suffered by some person.

Second, the other person must be one to whom the actor owes a duty of protection or assistance.

Third, the actor must have done or failed to do some act.

Fourth, the action or failure to act must have caused the damage.

Fifth, the action or the failure to act must have involved an unreasonable risk to others.

Sixth, the action or failure to act must not have

measured up to the standard of good practice under the circumstances.

Seventh, the failure to act must have been a failure to act in a way in which the actor had a duty to do.

General Statement of Law on Subject

It appears that the courts of all the American States are in agreement that a public water supply agency is not an insurer against loss caused by escape of water from its mains and services. Not being an insurer against such loss, it is held liable, however, if its negligent conduct, involving either action or inaction, caused the damage. Unless such negligent conduct can be legally established the person suffering loss caused by flooding from mains or services cannot recover against the owner or operator of those water works facilities.

It is recognized that transporting water through streets and public places, in pipes, under pressure, and with those pipes subject to external pressure of the earth and to other hazards, does involve an element of risk of harm to persons or property. It is, on the other hand, recognized that the public value of having a supply of water under pressure readily available out-weighs the risk involved. This being recognized, it follows from the legal definitions that so transporting water does not involve an unreasonable risk and that the transporting is not of itself negligent conduct. On the other hand, if the damage can be shown to have been caused by faulty installation of the facilities, or by failure in maintenance, or by improper operation, then such conduct or failure to act does involve an unreasonable risk of harm to others and becomes negligent conduct which may properly involve liability for damages.

In each case the question of liability for water leak damages turns on the facts. If the facts show that the agents of the water works were negligent in that they failed to act as well-trained water works men would act in the circumstances, then the water works has been guilty of negligence and may be liable for damages. The contrary is, of course, true—no negligence, no liability. The evidence presented by the plaintiff is often of such nature that the case must be allowed to go to the jury and the jury must then decide whether there was negligence. A water works attorney, called upon to advise his water works client on the handling of such claims, must rely on his judgment of how the provable facts will appeal to court and jury. In forming his judgement he will require advice from water works experts concerning good practice in installation, maintenance and operation of water works facilities.

Illustrative Cases

Most of the cases cited will be found to be from Pennsylvania courts. The reports of these cases and their later impact on the law are more readily available to this writer than are the cases from other states and have been used for that reason. However, past study of cases from other states and that of textbooks has led to the conclusion that the courts of all the states are in agreement on the general principles involved. Those general principles are the bases on which the cited cases were decided, but in presenting the cases here more attention has been given to the facts bearing on the question of negligence.

The first cases discussed are ones in which negligence was found. In other cases the facts were found to lead to the conclusion that there had been no such negligence and, hence, no liability.

Rumsey v. City of Philadelphia, 171 Pa. 63, opinion October 7, 1895—The plaintiff notified the city that water was leaking and found its way into his cellar. Officials came promptly to investigate but "after working a while * * * they ceased further effort but did not stop or find the leak. More efforts were made in the same direction after other notices from the plaintiff, but without success, until finally the plaintiff's plumber induced the city superintendent to intervene and he succeeded in discovering and locating the leak and stopped it * * * twenty-eight days after the first notice * * * ."

The Supreme Court ruled that: "Whether the efforts to locate and stop the leak were prosecuted with due diligence or were negligently conducted was a pure question of fact which was necesssarily submitted to the jury."

Here the jury found the city to have been negligent in finding and stopping a reported leak.

Schwindt v. Lehigh Water Company, 33 Pa., Superior 23, opinion February 25, 1907—The main was cast iron which had been in service for forty-six years. It had carried sixty pounds pressure for many years but the pressure was increased to one hundred ten pounds some time prior to the accident. The main was four or five feet under the street surface. Two years prior to the accident a trench had been dug in front of the plaintiff's property in order to effect a sewer connection in "close proximity to defendant's water main." After this trench was backfilled there was persistant settling of the soil. "The court could not say as a matter of law that the defendant should, or should not, have foreseen the exact cause inducing the street depression. The source of trouble was hidden, but is was right along or under the water main, * * *.

"The duty of the defendant under such circumstances was fairly defined by the trial judge in submitting that question of fact to the jury, viz: 'In the exercise of such care as an ordinarily prudent man would be required to make, was it incumbent upon them to make an inspection at different times and at periodical intervals along the lines upon the surface under which the pipes lay to ascertain whether or not there were any appearances of danger? Was there any reason to apprehend injury at any point anywhere along the line of the system?' It must be conceded that there was some unusual agency at work under the street, and whether it was originally due to a break in a pipe, or whether the break was caused by the subsidence of the soil under or around the pipe, or induced by independent causes, is not the controlling question to determine the defendant's liability. True, the water did not rise to the surface, but the settling of the street plainly indicated that the ground about the pipe was either settling to lower levels, or was being washed away through channels beneath the surface. This much, at least, the defendant should have known, and after two years of public notice of the facts it must be presumed to have had constructive notice of the condition then apparent to anyone. It may be that the water in the mains of such a service is not so dangerous as gas, but it may become dangerous when the pressure is practically doubled in pipes which have been in use for nearly half a century.

"In this case the cause of the plaintiff's damage was unquestionably the broken water pipe, which is spoken of as an old fracture. There was no effort on defend-

ant's part to locate or stop it, though the evidence of something being wrong about the pipe was plainly visible for nearly two years. Whether such supervision of its plant was due to diligence was a question of fact for the jury."

Herron v. Duquesne Boro., 34 Pa. Superior 231, opinion October 7, 1907—"The claim of the plaintiffs in the court below was for damages, resulting to a dwelling house, caused by negligence in the construction and maintenance of a water pipe belonging to the defendant municipality, laid along Patterson Avenue above the dwelling, the lot upon which the same was erected being upon a hillside which inclined at a sharp angle to Center street, 120 feet below.

"The pipe referred to was a part of the general water system owned by the municipality, through which the inhabitants of the borough were supplied with water.

"The assignments of error relate to the refusal of the court to affirm two several points for charge, the first of which was: 'If the jury believe, from the evidence, that the land on which plaintiffs' house stood and on which Patterson Avenue is laid out, all slipped down the hill together, thus causing damage to the plaintiffs' house, and also moving the borough's water line and causing it to leak, the verdict should be for the defendant.'

"Although the reasons for the refusal of the court to affirm this point are not distinctly stated, they become very clearly apparent from the general charge, in which the trial judge said: 'The plaintiffs' claim is that the negligence of the borough consisted in allowing this break to continue after it was known and not repairing it at once. That is the only ground on which the plaintiffs can recover here. If this damage was all done suddenly, at once, as soon as this break occurred, then the plaintiffs could not recover anything, because there is no evidence that the borough was liable for it; but, as I understand it, the plaintiffs' claim is that the continued running out of this water from the main for two or three months undermined these houses and that, while that was going on and before the injury was done, the borough had notice of the break. If that is true, that the borough had notice of the break and allowed it to run after they knew it was broken, and the break caused the damage, then the borough would be liable for the damage.' This is a practical affirmance of the point, with the qualification that if, after the break, the borough negligently allowed the water to escape and thereby injured the plaintiffs' property, it would be liable."

On p. 233: "This is practically the entire case, and inasmuch as there was evidence of notice to the borough authorities that the leak had occurred and was doing damage to the plaintiffs' property and that no repairs were made to the pipes for a considerable time, a question of fact was necessarily raised which carried the case to the jury."

Zimmer v. Philadelphia, 57 Pa. Superior 20, opinion April 20, 1914—"The plaintiff's case grows out of a break in a water main located under the surface of Twenty-ninth street a short distance north of Lehigh Avenue. The pipe was about four feet in diameter and a large volume of water flowed down Lehigh Avenue and into the cellar of the plaintiff on Oakdale street. The fact of the injury and its extent are not in dispute, the controversy being with regard to the sufficiency of the plaintiff's evidence to take the case to the jury. The evidence presented by the plaintiff was competent and tended to show that a fracture in the pipe had existed for a long time; that water had leaked through the pipe for some months; that the street had settled at or near the place where the break occurred and that irregularities and depressions existed in the surface sufficient to create the impression that a defect existed in the water main. Some of the witnesses testified that there was a wet condition of the street at intersection of Lehigh Avenue, that this had continued for a long time and that after the repair of the pipe the condition was not observed. A mechanical engineer called by the plaintiff examined the broken pipe and found as he alleged evidence that there was an old fracture and that water had been leaking from the pipe for a long time. Assuming that the evidence of these witnesses is true as the jury has found it to be an explanation is given of the settling of the street and the wet condition of the surface at the place described by the witnesses, and this evidence while not of the most convincing character was sufficient to establish a prima facie case and put the defendant on proof as is shown in Schwindt v. Lehigh Water Co., 33 Pa. Superior Ct. 23, and Koelsch v. Phila. County, 152 Pa. 355. The actual condition of things under the surface before the accident could not be observed; it could only be inferred from appearances noticeable on the surface. It was not for the court to say that the wet condition of the street existing for a long time and the evidences of settling or disturbance of the soil below the paving gave no indication that the water pipes were out of repair. The settling of the street was held to be a sufficient fact to put the defendant on notice in the case of Schwindt v. Lehigh Water Co., 33 Pa. Superior Ct. 23. The evidence offered by the defendant was quite contradictory of the plaintiff's testimony, but the weight of the evidence on the respective sides was a subject to which the trial court gave consideration in disposing of the motion for a new trial and is not now to be taken into account. We have only to decide whether binding instructions should have been given for the defendant. We are not convinced that the trial court was in error on this subject.

"The judgment is, therefore, affirmed."

Riegel & Co., Inc., v. Philadelphia, 296 State Reports, 258, opinion April 15, 1929—"The thirty-six inch express water main of the City of Philadelphia laid by it under the surface of Seventh Steeet burst about three o'clock in the morning of September 3, 1926, and poured great quantities of water into the cellar of a building occupied by plaintiff, damaging a stock of paper goods it had stored therein. This action was brought to recover compensation for the loss and resulted in a verdict in its favor for $17,128.79, upon which judgement was entered. Defendant thereupon took this appeal, contending that plaintiff has not shown a state of facts which under the law entitled it to recover."

On p. 200: "The portion of the main in front of plaintiff's building had been laid during July and August, 1925. In the early part of January, 1926, after it had been in use for a few months, and eight months before it burst, water began to escape into the basement of a building diagonally across the street from the one occupied by plaintiff. The engineer of the building immediately notified defendant's water department of the leakage and that in his opinion it was from the new main. The flow of water finally caused him to install a steam syphon in the basement of the building to syphon it out onto the street. No

water had leaked into the basement before January, 1926, and none after the break in the pipe which we are considering had been repaired.

"Four or five months prior to September 3, 1926, when the main broke, water from the street in amount equivalent to the flow from an ordinary hydrant began to escape into the basement of the premises next to those of plaintiff. The city was notified of this condition in March or April by telephone and by letter. In August the volume of water began to increase and the occupant of the building notified the city that the leak was increasing and that in his opinion it was becoming dangerous and that he believed it was from the main and called upon the city to send some one to look into the matter. The leak continued to grow in volume until the main burst. After it was repaired, the water ceased to escape into this building; none had run into it before the main was put in use.

"About August 20, 1926, water from the street began to run into plaintiff's building and continued to do so in increasing amounts until the main burst. The flow was sufficient to fill a pit six feet square by ten or twelve feet deep twice a day. The city was notified of the condition daily from the time the leak began on August 20th until the main burst. The attorney for the owners of the building on August 24th wrote to the chief of the water bureau saying that a serious leak in the water pipe had developed in front of it which was causing damage which threatened to increase rapidly, to which he received a reply dated October 7, 1926, more than a month after the main burst, saying a repair crew had excavated and found a leak on an abandoned service, the ferule of which was drawn. Water continued to leak into the building until the main burst; after it was repaired none did.

"In February, 1926, an experienced plumber, in making repairs at the adjoining property, uncovered the large main and found a stream of water equivalent to that from a 1-¼ inch pipe flowing underneath it.

"Defendant, so far as the proofs disclose, did nothing in persuance of the numerous complaints until August 25th, when some of its repair men arrived on the scene and between that date and August 28th made some attempts to locate the source of the leak. They found and repaired a leaking ferule at the corner of 7th and Arch Streets more than half a block from plaintiff's property. The leaking water from this source, however, was not escaping into the bed of the street but was running through the electric conduits laid therein. The stopping of this leak did not diminish the flow of water into plaintiff's building or into any of the others. During the entire time that the repair men were engaged in trying to locate the source of the escaping water they did not make any inspection of the large main, indeed, no examination of it was made at any time after leaks began to manifest themselves until it burst. On August 28th the repair crew was withdrawn and sent to another job, although they had not succeeded in finding the source of the escaping water, and for the six days preceding the bursting of the main, the city did nothing. After the main burst and while the city was repairing the break, discovery was made that water was escaping from a ferule located about twelve feet from the break. There was no evidence to show when it began to leak, whether before or after the break. From the havoc which was caused in the street by the flood which poured out, sixteen tons of water a second from the broken main, it might well have begun to leak then. We think it manifest from the evidence that this leak and

the one at 7th and Arch Streets were not the sources from which the water flowed into plainiff's and other buildings prior to the break."

On p. 236: "We are of opinion that there was sufficient notice given to the city prior to the break to put it upon investigation of all the possible sources of water leakage in the street, including the large main, to which its attention as a likely cause of the trouble was specifically directed by some of the complaints. It made no examination whatever of the large main. The leaking began shortly after it was installed; it ceased after the break was repaired. As has been noted, the broken ferules could not have been the seat of the trouble. After the first one of them was located and repaired, the volume of escaping water, in stead of diminishing, increased. We are impressed with the circumstance that when the city finally sent a repair crew to look into the situation, when it had become increasingly menacing, sufficiently so to call for a letter of warning from the attorney of the owners of the buildings affected, after making some ineffectual attempts to discover the source of the leakage, they abandoned the quest on August 28th, six days before the pipe burst, and in that interval did nothing. The city had ample notice that there was a leak in the street from its water system. In the light of the notices received, it was its duty to investigate all its water pipes in the street until the source was found. As was said in Rumsey v. Phila., 171 Pa. 63, 65, 'Whether the efforts to locate and stop the leak were prosecuted with due diligence or were negligently conducted was a pure question of fact which was necessarily submitted to the jury.'"

Hindes v. Pittsburgh, 155 Pa. Superior, 314, opinion July 15, 1944—On p. 318: "With this principle in mind, the narrow question remaining on this branch of the appeal is whether a property owner may recover for the injury caused to his premises by water which escapes from a service line in the exclusive control of a municipality and situated under the cartway of a public street where the municipality fails, for ten months after it has been apprised of the possibility of a defect, to inspect and repair the pipes at the place complained of. The law is now too well settled to admit of doubt, and it is clear that under such circumstances

the municipality may not avoid responding in damages. 'The burden rested upon the plaintiff of showing that her damages resulted from the negligence of the defendant and this she could have done by showing the injury to her property by the water escaping from the defendant's line followed by evidence of unreasonable neglect in repairing the line after actual notice, or for so long a time that the jury could infer negligence on the part of the borough officials in not discovering the defect in the line even without notice': *Morgan v. Duquesne Borough,* 29 Pa. Superior Ct. 100, 105. 'The moment the water was stopped off from entering the extended pipe, the leak ceased, after all other efforts to discover it were exhausted without any success. It is impossible to doubt the leak came from this pipe, and as it was a pipe over which the plaintiff had not the slightest control and the defendant had exclusive authority, the responsibility for its defects was cast upon the city': *Rumsey v. Philadelphia,* 171 Pa. 63, 66, 32 A. 1133. See also, *Riegel & Co., Inc., v. Philadelphia,* 296 Pa. 256 145 A. 837 *Herron v. Duquesne Borough,* 34 Pa. Superior Ct. 231; *Zimmer v. Philadelphia,* 57 Pa. Superior Ct. 20; *Boyle v. Pittsburgh,* 145 Pa. Superior Ct. 325, 21 A. 2d 243. Appellant's motion for judgement n.o.v. was properly refused."

Several cases in which recovery was denied will be sufficient to establish the principles.

Morgan v. Duquesne Borough, 29 Pa. Superior 100, opinion October 9, 1905—On p. 102: "The learned counsel for the appellant concedes that the municipality established and owned a water plant and that it was engaged in supplying water to the inhabitants of the borough, for gain. But he contends vigorously that the plaintiff could not recover without showing that the municipality was negligent, either in the construction of its water plant or in maintaining it in a proper condition after it was constructed. He further contends that the plaintiff could not recover for an injury caused by a leak in one of said water mains without showing notice to the defendant of said leak, either actual or constructive. In short, he contends that the plaintiff's evidence was not sufficient to entitle her to recover."

On p. 104: "In this action of trespass the plaintiff's right to recover depends upon her injury resulting from the negligence of the defendant. Therefore, she was bound to show that the alleged damages resulted from either a faulty or negligent construction of the defendant's water line or, the same being properly constructed, it had become out of repair and was and had been leaking so that the borough was negligent in not repairing the line after notice, actual or constructive, of its condition, or that the borough was guilty of negligence in failing to exercise proper care, caution and diligence; such care, caution and diligence as, under the circumstances, reasonable and ordinary prudence would require to be exercised. As was said in Kibele v. City of Philadelphia, 105 Pa. 41, (see p. 44): 'It may consist as well in not doing the thing which ought to be done, as in doing that which ought not to be done, when in either case it has caused the loss and damage to another. Hence, in this case, one question to be determined is, whether the municipality acting through its officials, failed to exercise such care and diligence in not ascertaining the nuisance, and in not removing it prior to the injury sustained by the plaintiff.'

"In the case under consideration the defendant might be liable, (1) under actual notice; (2) under constructive notice and (3) if the officers of the borough could and ought to have ascertained that the line was leaking and for some time had been damaging the plaintiff's property, provided, they had used such reasonable care and diligence in the inspection and examination of their line as they ought to have done."

On p. 105: "The third assignment in substance raises the question that the court erred in instructing the jury, practically, that if the water from the defendant's pipe line flowed upon the property of the plaintiff and damaged the same, then the jury should proceed to assess the damages. In substance, the learned court charged that the borough was liable if the water from its line injured the plaintiff's property and this without notice and without finding that the defendant was guilty of negligence. In this view of the law we think the learned court erred. The burden rested upon the plaintiff of showing that her damages resulted from the negligence of the defendant and this she could have done by showing injury to her property by the water escaping from the defendant's line, followed by evidence of unreasonable neglect in repairing the line after actual notice, or for so long a time that the jury could infer negligence on the part of the borough officials in not discovering the defect in the line even without notice. The borough cannot defend as a matter of law because its officials had neither actual nor constructive notice. There may be a recovery on the ground of negligence of the borough officials in not making reasonably careful inspection of its water lines from time to time. All of these questions of notice and negligence in failing to discover and remedy the defects in the water line were properly for the considerations of the jury."

Allied Realty Company v. City of Philadelphia, 95 Pa., Superior 62, opinion December 14, 1928—"This is a suit for damages to a building and the contents thereof located at 117-19-21 North Seventh Street, Philadelphia, caused, as alleged, by the bursting of defendant's thirty inch water main laid under the surface of Seventh Street and in front of plaintiff's property. At the trial a non-suit was entered and this appeal is from the refusal, by the court below to take it off.

"Assuming the truth of plaintiff's evidence and giving it the benefit of every inference fairly deducible therefrom, it appears that in June, 1926, water which came from some pipe in defendant's system began to leak into the premises adjoining the plaintiff's, and notice thereof was given to the city. The city's inspectors made an investigation by digging up the pavement in front of that property and elsewhere. They found a small pipe leaking and repaired it, but the water continued to seep in. On or about Auqust 20, 1926, there was a small leakage of water into plaintiff's cellar. The plaintiff notified the Water Bureau and its inspectors made an investigation for the purpose of finding the cause of leakage. They found a small leak and fixed it, but the water continued to run into plaintiff's cellar causing two or three inches of water to accumulate each night on the boiler room floor. On the morning of September 3, 1926 the high pressure main broke, causing a flood which damaged plaintiff's property. After it was repaired the leakage into the plaintiff's cellar stopped. The fact of plaintiff's injury and its extent is not in dispute, the controversy being with regard to the sufficiency of its evidence to take the case to the jury. There was no testimony as to the character of this break in the main and no proof that

there was any connection between it and the prior leakage. The latter is not set up as a cause of action, and no damage is claimed on account of it.

"The mere fact that water from the ruptured main injured the plaintiff's property did not create a prima facie liability. Defendant's liability depends upon whether or not it was negligent. That negligence may consist of faulty construction of the main or failure to make a reasonably careful inspection from time to time, or failure to repair after actual or constructive notice of a defective condition: Morgan v. DuQuesne, 29 Pa. Superior Ct. 100. See also Abraham v. Yardun, 64 Pa. Superior Ct. 225, in which the cases dealing with liability in cases like this are reviewed. It is not asserted that the main was not well constructed of proper materials and suitable for the purpose. Nor is there any evidence of the failure to inspect, nor of any notice, actual or constructive, that the main had become defective or out of repair. The fatal defect of plaintiff's case is that there is no evidence of any connection between the break of the main and leakage which preceded it. An inference that there was any connection between them would have to rest upon pure surmise. The large main was not the only water pipe in the street. There was no evidence of when it was laid, nor of the condition of the material in it after the break. So far as appears, the break may have been the result of a latent defect which would not have been disclosed by the uncovering of the pipe. No witness testified that a proper inspection required the uncovering of the main. No one is required to do a vain thing or make a useless inspection: Lentz v. Allentown Bobbin Works, 291 Pa. 526. If there had been any evidence to support the inference that the defendant ought to have suspected that the water which was running into plaintiff's cellar prior to the break in the main was coming from it, the case would present a different aspect. But there the case fails. The cases cited for the appellant in support of its contention are not controlling here, because all of them may be differentiated from this case upon their facts. We all agree that the court below properly refused to permit a recovery and that the entry of a non-suit was justified.

"The judgment is affirmed."

Res Ipsa Loquitur—New York State. *Foltis v. New York City*, 287 N.Y. 108.

The courts of New York State seem to have given more weight to the doctrine of res ipsa loquitur than have those of most of the other states. The phrases may be translated as "The thing speaks for itself." It is a rule of evidence. The idea on which it is based is that the party in control of the instrumentality causing injury and who has access to all known facts should come forward with the facts. In the law of escaping water from mains the public water supply agency owns the facilities, should know their history and condition, it is in charge of them; water escapes from them; the thing speaks for itself, the owner is liable. That is a very rough and, perhaps, not quite accurate statement of the idea. There are New York cases in which the doctrine has been applied in very disturbing ways. It is gratifying to be able to point out that the New York Court of Appeals in the case of Filtis, Inc., v. City of New York, 287 N.Y. 108, decided in December 1941, appears to have brought some order into the confusion apparent in the earlier cases.

The court absolves the lower courts in those cases of blame by admitting that its own language in other cases dealing with the doctrine has often been confusing and inconsistent. Now it appears that the only good the doctrine of res ipsa loquitur does for a plaintiff is to establish a prima facie case. The plaintiff still has the burden in water leak cases of proving negligence. It thus appears from this case of Filtis v. New York City that the New York courts are in substantial agreement with those of the other states. The case is well worth reading but is too long for even partial quotation here.

Chlorine Accident at Bay City, Mich., Plant

One of the subjects discussed at the operator training meetings in Michigan this past winter was the handling of chlorine and the hazards arising from improper control procedures. During one session John Sherbeck, chief operator at the Bay City plant, gave a graphic account of a chlorine accident. This situation was typical of what can happen in any plant, so his brief statement of the circumstances, as reported in the *Michigan Sewage Works Bulletin*, is repeated here.

"On August 19, 1955, the operator and assistant operator on duty at the Bay City sewage treatment plant were changing one of the ton chlorine gas containers on the line in the chlorine room. A valve was accidentally turned on, and gas from two full ton containers escaped into the building and yard surrounding the plant. First attempts to get to the gas mask, located in the hall adjacent to the chlorine room, failed. After closing the hall door to the outside, the gas settled sufficiently to allow the operator, James Fogelsonger, to get the mask and shut the valve.

"In all, 700 pounds of chlorine gas escaped. Four employees were hospitalized for treatment and observation.

"The following changes were made to prevent reoccurrence of this type of accident:

"1. Gate valves were placed in each arm of the pipe to the chlorinating equipment.

"2. The position of the shutoff valves at the connection point was changed so that they can not be accidentally opened.

"3. A second gas mask was placed in an outlying area.

"4. Orders were given that (a) two men must be present when changing chlorine containers, and (b) a gas mask must be carried by one of the men during a change of chlorine tanks.

Mark Hollis Honored by Univ. of Florida

Mark D. Hollis, Assistant Surgeon General and Chief Engineer of the U. S. Public Health Service, was awarded the honorary Doctor of Science degree by the University of Florida on January 28, 1956, at the mid-year commencement exercises.

The citation accompanying the degree reads: "Mark D. Hollis, distinguished son of our neighboring State of Georgia, scientist, engineer, planner, administrator, and public servant; a leader in making our country and the world a better and more healthful place in which to live."

Mr. Hollis also was principal commencement speaker, addressing the 500 graduates.

More on Water Works Rates

An Open Letter from One Superintendent to Another

Dear Bill,

Some months ago, I remember you showed me a letter that "Sy" had written you about the "Curse of Low Water Rates". I was reminded of the problem last spring when I went "across the border" to the Canadian Sect. AWWA meeting. At one session they had one of their typical "Guided Discussions", this one on "Water Rate Trends".

If you've never attended a Canadian Section Guided Discussion, you have missed a unique and highly useful type of convention session. Some time before the program is made up the secretary or program chairman selects a "hot" topic and asks one person to preside over that subject. Then three, four, or five others are asked to prepare a short discussion of the topic, drawing on their own experience. The speakers are not listed on the program. After these previously prepared comments have been presented, the matter is thrown open for free discussion by the audience. It's amazing how much exchange of good information occurs at these sessions.

Trends in Water Rates

At the session where "Water Rate Trends" were discussed, Frank Dorrance, Cons. Engr., Pub. Wks. Dept., Montreal, Que., opened the discussion with the comment that the water works industry was no different from other elements of the general economy. It, too, had been subject to inflation for the past 20 years, and is now faced with the problem of obtaining more revenue to meet replacement, operation, and expansion costs, all of which have increased markedly in the past two decades.

Private companies and municipal systems which are regulated by a Public Utilities Commission, etc. (as in Wisconsin), can only obtain these necessary funds by increasing rates. Some other municipal utilities have reversed the usual situation and transferred funds from the general treasury to the water department. This practice is just as bad—reprehensible, in fact—as transferring water works income to the general fund.

Factors Affecting Rates

What are some of the factors which contribute to the need for increased revenue rates? As Mr. Dorrance pointed out, to begin with, there is the matter of depreciation. Funds set aside for depreciation reserves are still largely based on old depreciation rates, which are far below present depreciation funding needs because replacement costs for outworn equipment have increased many fold.

Added to this depreciation and replacement factor is that of expansion needs. Indeed, there are few water works which are not or have not been faced with a need for expansion to meet increases in industrial activity, population and per-capita consumption.

Another important factor is that of operation costs. Consider increases in wage rates and cost of supplies plus reduction in hours per man, pensions, insurance and other fringe benefits, all of which affect labor costs. It is easy to understand why operating costs have more than doubled in many plants in the past 20 years.

Other Reasons

The Town Engineer, Shawinigan Sud, Quebec, a Mr. C. H. Boisuert, said that within the past ten years some 600 privately owned water works in Canada, ranging in size from a few users to hundreds, had applied for and obtained increased rates from the Public Service Board. Reasons given included those mentioned above plus (a) the demand for better service which in itself required improvements in facilities, better maintenance, and better administration, and (b) delayed improvements and maintenance during the war and postwar periods.

Each year approximately 10 per cent of the water works owners in Canada apply for rate increases; and increases granted have varied from 25 to 100 per cent. Most changes in rates are based on a complete revision of schedules because the old ones were so out of date. In a few cases, increases are based on a percentage of existing rates.

Mr. Boisuert said some water works wait too long to ask for an increase in rates. When they wait two or three years too long, they may need so large an increase that it's too large to be acceptable to the users. I guess he figures it's better to increase several times in jumps that match inflation rather than to make one big jump in rates.

Revamping Schedule

J. W. Churchill of Halifax, Nova Scotia, said his utility raised rates in 1948, the first raise since 1926. In that 22-year period wages and salaries had increased more than 100 per cent and extensive rehabilitation of the system had been done. The rate increase averaged 40 per cent; but some rates were increased as much as 350 per cent, while some large users had their minimum rates increased ten-fold. Fire protection rates were increased 23 per cent. In short, after a lapse of 22 years it was necessary to do a complete overhaul of the rate schedule.

That gives you some idea of the situation in Canada. It's not much different from conditions here in the States, but I was particularly interested in that comment about some utilities waiting too long to ask for rate increases. From my point of view that's an indictment of the management of the utility. Believe me there are many water works in this country that stand so indicted—too many, in fact.

You've heard the old saying about how things will get worse before they get better. Well, in the water works industry there is no such thing as getting better. Regardless of the condition of the economy in the future, unless a utility has raised its rates recently, it is in for trouble until it does. Even a severe deflation will only alter the picture to a degree. No one wants a severe deflation, even if it were to help the situation in water utilities. Therefore, we must look forward to increased demands for service, increased costs of operation, increased replacement costs, and so on. Our only "out" is to adopt a realistic schedule of water rates, which means get rid of those cursed low rates. I'm working on a new schedule now. Are you?

Yours, Joe

Designing, Constructing and Maintaining Centrifugal Pumps

Part 10 – Axial Thrust

by ROY CARTER and IGOR J. KARASSIK

Mr. Carter is manager of the Volute Pump Section, and Mr. Karassik is manager of Multistage Pump Section, Centrifugal Pump Division, Worthington Corp., Harrison, N. J. This new series has been prepared by Messrs. Carter and Karassik to review characteristics of centrifugal pumps for water and sewage service.

IN CENTRIFUGAL PUMPS there can be unbalanced hydraulic forces acting axially, requiring the use of a thrust bearing or a balancing device to maintain the rotor in proper axial location. Except in certain high-pressure and very large pumps, the axial thrust that could be developed in a single-stage pump is not of particular concern, as thrust bearings with large thrust capacity are now available.

Double-Suction Impellers

As illustrated in Fig. 1 (left), a double-suction impeller is theoretically in hydraulic axial balance with equal pressures on both sides counterbalancing each other. In practice this may not be true for a number of reasons. First, the suction passages to the two suction eyes may not give equal or uniform flows to the two sides, with resulting unequal pressures. Second, external conditions, such as an elbow too close to the suction nozzle of the pump, may cause unequal flows to the two suction eyes of the impeller, with a resulting difference in pressure. Third, the two sides of the discharge waterways of the casing may not be symmetrical or the impeller may be located off center, resulting in different flow characteristics of the water between the impeller shrouds and the casing, with unequal pressures on the two shrouds. Fourth, there may be unequal leakage through the two leakage joints, which would also tend to upset the balance.

Single-Suction Impellers

Single-suction impellers are made in several forms, some with rings and others with pump-out vanes on the back to equalize the pressures. One type without such devices, shown in Fig. 1 (right), has a single-suction impeller with shaft extending through the eye. As can be seen from that figure, the areas on both sides from the wearing ring diameter out to the periphery are subject to discharge pressure, but the area between the shaft and wearing ring diameter is subject to suction pressure on one side and to discharge pressure on the other.

Actually, the pressure acting on the two walls of a single-suction impeller is not uniform over the entire area exposed to the discharge pressure. This lack of uniformity is derived from the fact that the liquid trapped between the impeller shrouds and the casing walls is in rotation and the pressure acting at the periphery of the impeller is appreciably higher than the pressure at the impeller hub. While there is no particular interest in the derivation of the theoretical calculations necessary to determine this pressure variation, a qualitative presentation of this variation is illustrated in Fig. 2. Therefore, the axial thrust acting towards the suction of the impeller is somewhat less than the net pressure times the unbalanced area. As an approximation,

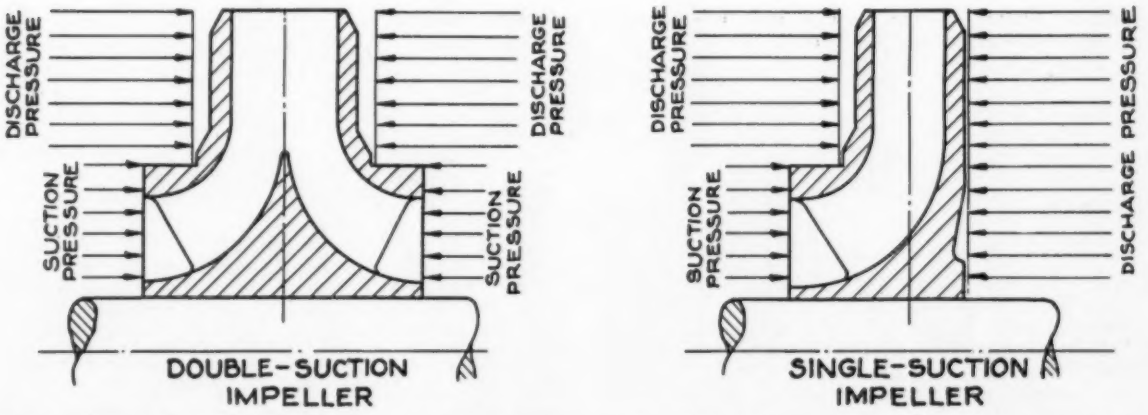


Fig. 1—ORIGIN OF PRESSURES acting on areas of a double-suction impeller (left) and one type of single-suction impeller (right) to produce axial thrust

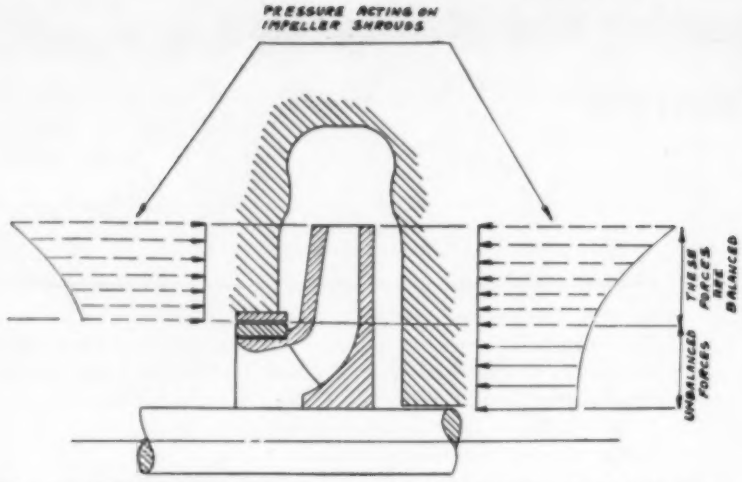


Fig. 2—ACTUAL PRESSURE distribution on front and back shrouds of single-suction impeller with shaft through impeller eye

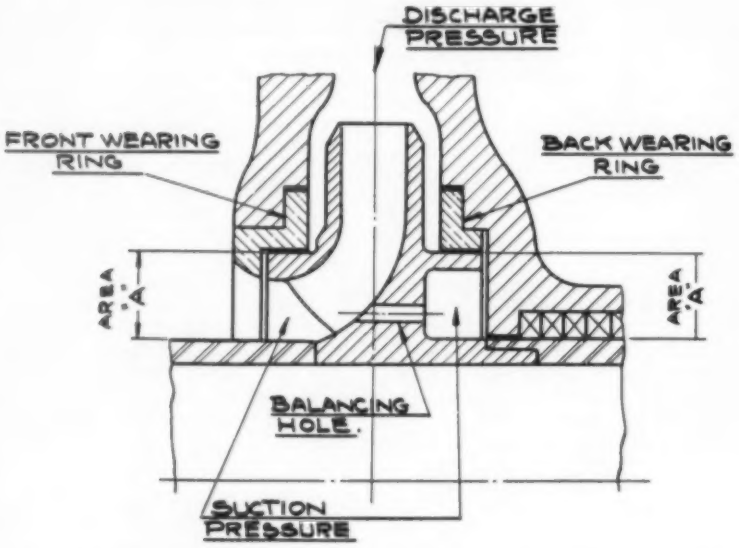


Fig. 3—BALANCING axial thrust of single-suction impeller by means of wearing ring on back side and balancing holes

it can be said that this thrust may range from 70 to 80 per cent of the value which would be based on the assumption of a uniform pressure distribution.

Balancing of Thrust

In order to eliminate the axial thrust of a single-suction impeller, it is possible to provide it with wearing rings both in front and in back, the inner diameter of both rings being made the same so as to equalize the thrust areas, as shown in Fig. 3. The pressure in the chamber located inwardly of the back wearing ring is maintained substantially equal to the suction pressure by drilling so-called balancing holes through the impeller. The leakage past the back wearing ring is returned into the suction area through these balancing holes. In certain cases—especially when large single-stage single-suction pumps are involved—the use of balancing holes is considered disadvantageous because the leakage through these holes issues into the impeller suction in a direction opposite to the main flow, creating undesirable disturbances. The balancing holes are then replaced with a piped connection to the pump suction.

Another method used to eliminate or reduce the axial thrust of single-suction impellers is the provision of pump-out vanes on the back shroud of the impeller. The effect of these vanes is to reduce the pressure acting on the back shroud of the impeller (Fig. 4). Such construction, however, is mostly limited to pumps handling gritty liquids, where it serves the primary purpose of keeping the clearance between the impeller back shroud and the casing free of foreign matter.

So far, the discussion of the axial thrust with single-suction impellers has considered those where the shaft passes through the impeller eye and where the pump is provided with two stuffing boxes, located on both sides of the impeller. In such a case, the magnitude of the suction pressure does not affect the resulting axial thrust. On the other hand, the axial forces acting on an overhung-type impeller with a single stuffing box (as in Fig. 5) are definitely affected by the suction pressure. This is due to the fact that, in addition to the unbalanced force illustrated in Fig. 2, there is an axial force equivalent to the product of the cross-sectional area of the shaft through the stuffing box and of the difference between the suction pressure and the atmospheric pressure. This force, therefore, may act either towards the impeller suction when the suction pressure is less than atmospheric, or in the opposite direction when it is higher than atmospheric.

The magnitude of this force when the pump handles a suction lift is very low. For instance, if the shaft diameter through the stuffing box is 2 inches (area = 3.14 square inches) and if the suction lift is equivalent to 20 feet of water (absolute pressure = 6.06 psi), the axial force due to the use of the overhung impeller and acting towards the suction will be only 27 pounds, very little indeed. If the suction pressure is 100 psi gage, the force will act in the opposite direction and will be 314 pounds. It is obvious, therefore, that since the same pump may be applied to a variety of conditions of service over a wide range of suction pressures, the thrust bearing of pumps with single-suction overhung impellers must be generally arranged to take thrust in either direction and must be selected with a thrust capacity sufficient to counteract forces set up under the maximum suction conditions which have been established as the maximum limit for the particular pump in question.

Generally the heads involved with pumps with mixed-flow and axial-flow impeller are low and the maximum

thrust that could be developed even without rings on the back side is not of very large magnitude except in very large sizes and certain special applications.

In the case of axial-flow impellers, there is an axial thrust caused by the pressure imposed on the vanes as they act on the water. In addition, there is a difference in pressure acting on the two ends of the shaft hub, one end being subject to discharge pressure and the other to suction pressure. Occasionally, provision is made in an axial-flow pump for a leakage joint at or near the periphery of the discharge hub, with balancing holes through the hub. This construction is used mainly in vertical wet pit pumps with covered shaft designs, in order that the seal at the lower end of the cover pipe be subjected to suction pressure rather than to discharge pressure.

In the case of mixed-flow impellers, the axial thrust is a combination of the forces caused by action of the vanes on the water and of the forces arising from the difference in the pressures acting on the various surfaces. It is common practice to provide wearing rings on the back side of mixed-flow impellers and either balancing holes through the impeller hub or an external balancing pipe leading back to the suction.

In some designs of large mixed-flow impellers, as well as some high-head vertical pumps with single-suction radial-type impellers, the leakage joint on the back side of the impeller used to be made larger in diameter than the leakage joint on the suction side. Such construction causes the axial thrust to act upwards, balancing the dead weight of the rotor and tending to lift it upwards. This practice has fallen into disuse since more reliable thrust bearings have been made available.

The use of wearing rings on the back side of large-capacity sewage pumps with mixed-flow impellers does not meet with general approval and is therefore seldom encountered, even though their absence leads to the necessity of larger capacity thrust bearings.

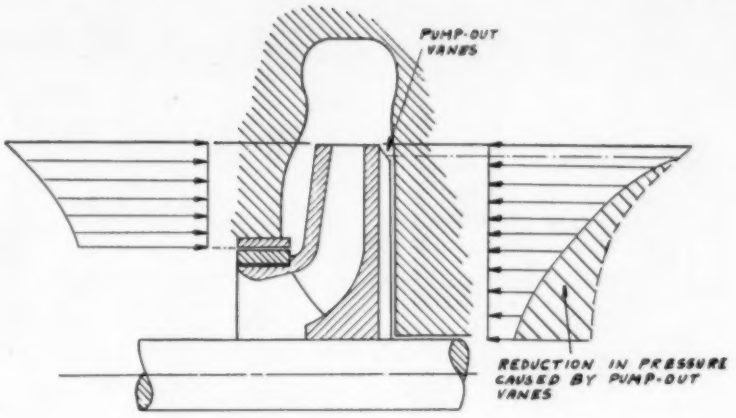


Fig. 4—EFFECT of pump-out vanes on a single-suction impeller to reduce axial thrust

Multistage Pumps

The virtual absence of unbalanced axial thrust and the greater suction areas available in a double-suction impeller would appear to be of sufficient advantage to apply such impellers to multistage pumps as well. This design,

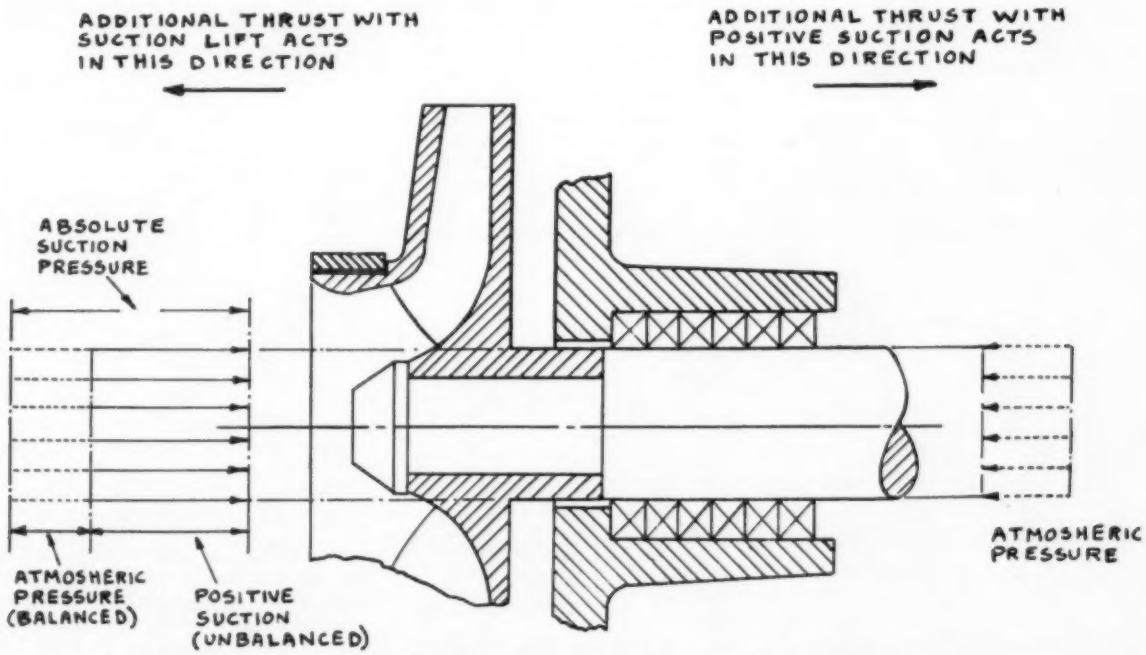

ADDITIONAL THRUST WITH SUCTION LIFT ACTS IN THIS DIRECTION
ADDITIONAL THRUST WITH POSITIVE SUCTION ACTS IN THIS DIRECTION
ABSOLUTE SUCTION PRESSURE
ATMOSHERIC PRESSURE (BALANCED)
POSITIVE SUCTION (UNBALANCED)
ATMOSHERIC PRESSURE

Fig. 5—AXIAL THRUST problem involved with single-suction overhung impeller with single stuffing box

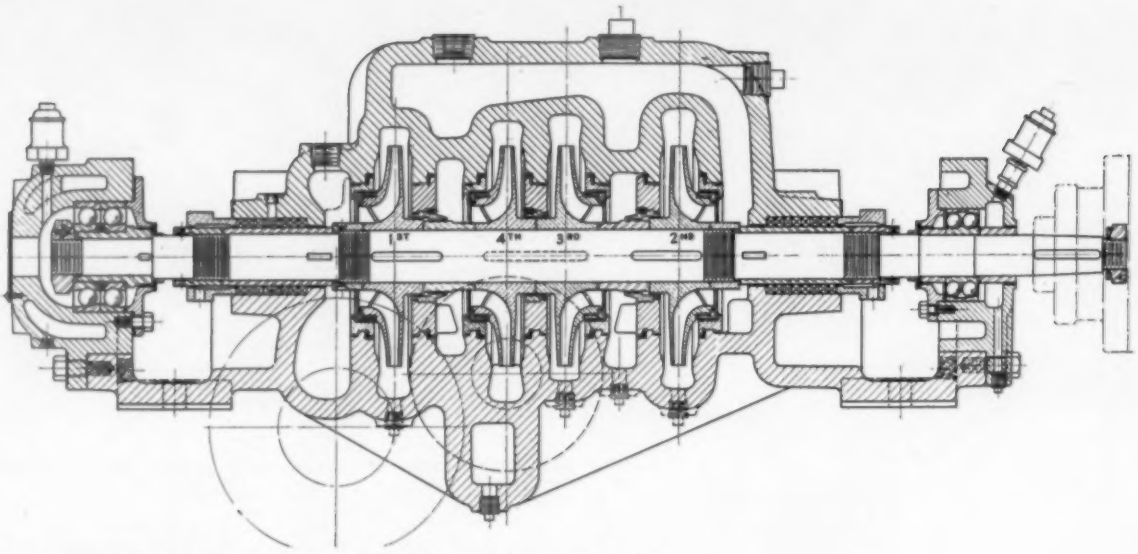


Fig. 6—MULTISTAGE pump with "opposed" impellers to balance axial thrusts

however, when applied to multistage units, involves certain definite shortcomings. The average multistage pump is of relatively low capacity when compared to the entire range covered by modern centrifugal pumps. As a result, it is seldom necessary to use double-suction impellers for the sole purpose of reducing the net positive suction head required for a given capacity. Even if a double-suction impeller becomes desirable for the first stage of a large-capacity multistage pump, it is hardly necessary to use such impellers for the remaining stages. As to the advantages to be derived from the axial balance of a double-suction impeller, it must be considered that a certain amount of axial thrust is present in all centrifugal pumps and, therefore, the necessity of a thrust bearing is not eliminated.

The shortcomings of the use of double-suction impellers in a multistage pump lie mainly in the fact that this construction adds needless length to the pump shaft span. Additional space is required for the extra passage leading to the second inlet of each successive stage and, in the case of a pump with four or more stages, this increase in shaft span becomes quite appreciable, to say nothing of the added casting difficulties. In the event the shaft diameter is increased to compensate for the longer shaft span so as to maintain a reasonable shaft deflection, the areas of the impeller inlets are correspondingly reduced, with the result that the margin of advantage of the double-suction impeller design from the point of view of suction conditions becomes even less appreciable. Finally, since it appears impractical to arrange the various impellers within a double-suction multistage pump in any order other than the ascending order of the stages, it follows that the impeller at one end of the casing on the adjacent stuffing box will be the discharge pressure of the next to last stage. To reduce this pressure, it becomes necessary to interpose between the last stage impeller and the stuffing box some form of pressure reducing bushing, which further increases the overall length. As a result of these considerations, the majority of multistage centrifugal pumps are built with single-suction impellers.

There are two obvious arrangements of single-suction impellers for a multistage pump, as follows:

1. Several single-suction impellers may be mounted on one shaft, each of these impellers having its suction inlet facing in the same direction, the stages following each other in the ascending order of pressure. The axial thrust is then balanced by a hydraulic balancing device, as will be described later in this article.

2. An even number of single-suction impellers can be mounted on one shaft, half of the impellers facing in a direction opposite to the second half, so that the axial thrust in one direction on half of the impellers is compensated by the thrust in the opposite direction acting on the second half (Fig. 6). This mounting of single-suction impellers back-to-back is frequently referred to as "opposed impellers."

This last arrangement can be changed to use an uneven number of single-suction impellers, provided the resulting axial unbalance is taken care of by the proper choice of shaft and interstage bushing diameters, so as to

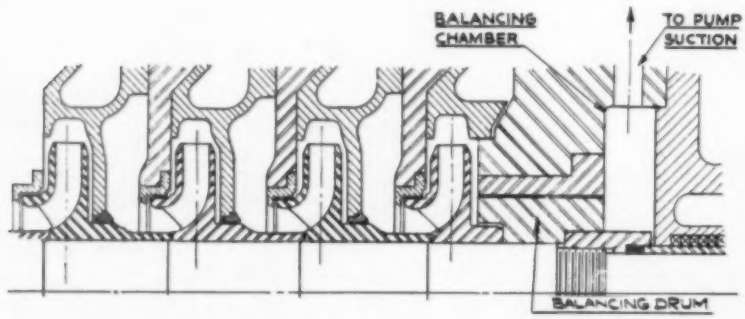


Fig. 7—BALANCING DRUM to offset axial thrust in a multistage pump with impellers not opposed

give the effect of a hydraulic balancing device to compensate the hydraulic thrust of one of the stages.

Once a multistage pump is balanced through the use of opposed impellers, it remains to determine the most satisfactory sequence in which the individual stages are to be arranged within the pump casing. There are three separate factors which enter into the analysis of a satisfactory stage arrangement and the final solution must, perforce, become a compromise between the individual "best" solutions, each of which satisfies the following three factors:

1. The pressure difference between any two adjoining stage chambers should be kept to the minimum possible and several low-pressure running joints are to be preferred to a fewer number of joints subject to a relatively high pressure.
2. The various stage impellers should be so arranged that the stuffing boxes will be subjected to the lowest pressure within the pump.
3. The sequence of the stages should be such as to avoid excessive complications in the forming of the interstage passages.

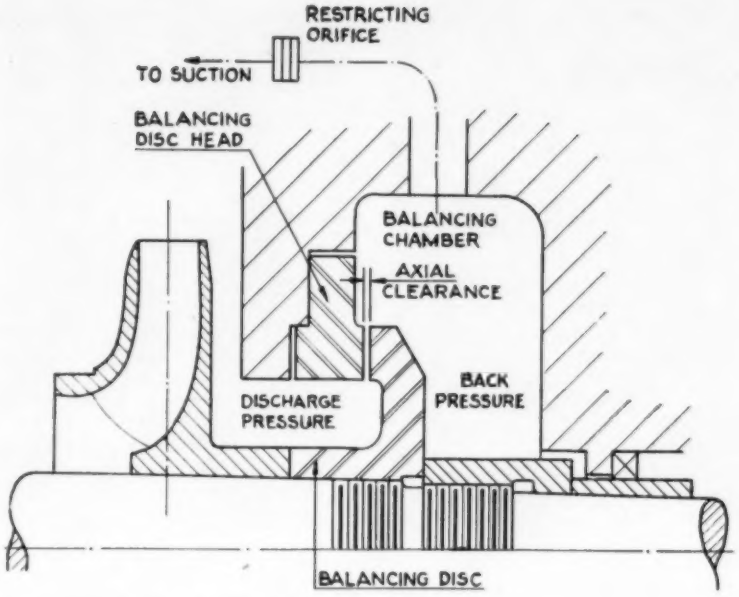


Fig. 8—SIMPLE BALANCING DISK to equalize axial thrust

Balancing Drum and Disk

As mentioned previously, some multistage pumps are made with a number of single-suction impellers on one shaft, all facing the same way, and a hydraulic balancing device is used. This may be a balancing drum, a balancing disk, or a combination disk and drum. Since readers of *Water and Sewage Works* would not be likely to encounter pumps with such devices, these will be discussed only briefly and without much detail.

A typical balancing drum is shown in Fig. 7. The construction involves a drum mounted on the shaft at the high-pressure end running in close clearance with a stationary ring called a balancing drum head. The chamber at the stuffing box end of this leakage joint is at the same pressure (or approximately so) as the first-stage suction pressure. The drum and drum head, therefore, acts similarly to the back wearing ring shown in Fig. 3, but with a differential of the full head developed by the pump. By proper selection of the drum diameter all or part of the axial thrust can be balanced. Often only 90 or 95 per cent of the thrust is balanced and the balance is carried on the thrust bearing.

The operation of a simple balancing disk is illustrated in Fig. 8. The disk is fixed to and rotates with the shaft, being separated from the balancing disk head by a small axial clearance. The leakage through this clearance flows into the balancing chamber and thence to the pump suction, just as in the case of the balancing drum. The back of the balancing disk is subject to the back pressure in the balancing chamber, while the face of the disk is acted upon by an intermediate pressure which is equal to the discharge pressure at the smallest diameter of the disk and to the back pressure at its periphery. The inner and outer diameters of the disk are so chosen that the difference between the total force acting on the disk face and that acting on its back balance the axial thrust exerted upon the impellers.

If at any time in operation the axial thrust of the impellers exceeds the force acting on the disk in the opposite direction, the latter is moved towards

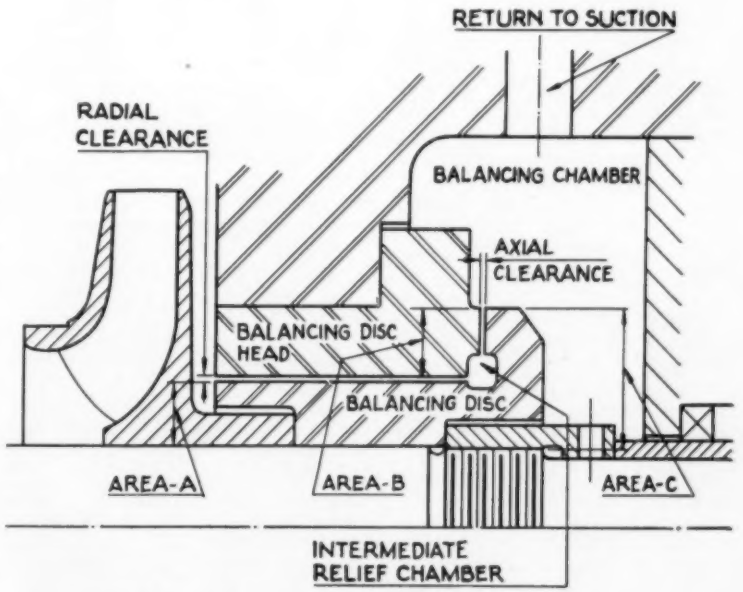


Fig. 9—COMBINATION balancing disk and drum

the disk head, reducing the axial clearance between the disk and the disk head. The amount of leakage through the clearance is reduced, with the result that the friction losses in the return line are also reduced, lowering the back pressure in the balancing chamber. This automatically increases the pressure difference acting on the disk and moves it away from the disk head, increasing the clearance. Now, the pressure builds up in the balancing chamber and the disk is again moved towards the disk head until an equilibrium is reached when the thrust forces balance in both directions.

The operation of the combination balancing disk and drum is illustrated in Fig. 9. The rotating portion of the balancing device consists of a long cylindrical body which rotates within the drum portion of the disk head, followed by a disk similar to the one previously described. The radial clearance is, of course, constant regardless of the position of the disk, while the axial clearance varies with the axial position of the pump rotor. It will be seen that the forces acting toward the discharge end are made up of the sum of the discharge pressure times area A plus the average intermediate pressure times area B, whereas the force acting towards the suction end is the back pressure times area C.

While the "position-restoring" feature of the simple balancing disk was based on the wide variation of the back pressure, which should preferably be kept to as nearly a constant value as possible, it now becomes possible to depend upon a variation in the intermediate pressure to achieve the same effect. This is accomplished in the following manner: when the pump rotor moves toward the suction end (to the left in Fig. 9) because of an increased axial thrust, the axial clearance is reduced and pressure builds up in the intermediate relief chamber, increasing the average value of the intermediate pressure acting on area B.

In other words, with a reduced leakage the pressure drop through the constant radial clearance decreases, increasing the pressure drop across the axial clearance. The increase in the intermediate pressure forces the balancing disk towards the discharge end (to the right in Fig. 9) until an equilibrium is reached. Movement of the pump rotor toward the discharge end, on the other hand, would have the effect of increasing the axial clearance, increasing the leakage and decreasing the intermediate pressure acting on area B.

The next two parts of this series will deal with bearings, both line and thrust, of both anti-friction and babbitted types.

Urban Water Supply Needs Outlined By Public Health Service Inventory Report

More than one out of four of the larger urban areas have reported they will need additional water supplies to meet municipal and industrial growth, the U.S. Public Health Service recently revealed in announcing the results of a nationwide inventory of 1,532 community water facilities. Of these, 367 areas with a total population of nearly 20 million said they would need additional supplies.

The inventory covered all facilities serving 10,000 people or more and a 40 per cent sample of those serving between 5,000 and 10,000. The survey was carried out under a delegation by the Office of Defense Mobilization as part of the government's mobilization readiness planning activities. It lists, among other things, population served, source of supply, treatment provided, capacity, storage, and the improvements which local officials consider necessary to maintain satisfactory service.

Gordon E. McCallum, Chief of the Service's Water Supply and Water Pollution Control Program, said that the development of additional water supplies to support expected population and industrial growth will present a problem in areas where convenient and economical sources have already been fully developed.

"In recent years, many cities have experienced water shortages during periods of low rainfall," Mr. McCallum pointed out. "Such situations are likely to increase in both number and severity as population and industry continue to expand. Cities are doing extensive advance planning to meet expected future demands for water. In many instances, sizeable water development projects will be needed.

"Greater conservation of available water resources through pollution control is becoming more and more important in many areas," Mr. McCallum added. "Adequate treatment of wastes to permit more extensive use of available surface water is the logical answer to some of the present supply problems."

More than half of the water supply facilities covered by the survey were reported as needing improvement or enlargement, but not all of these involve development of new sources of supply. About one-fourth of the facilities need additional distribution systems. The Public Health Service said this was due in part to the growing practice on the part of municipalities to provide water service to suburban areas.

A preliminary breakdown of needs as reported by the various communities follows:

Needed Improvements	No. of Facilities	Pop. Served, 1,000's
New underground sources	259	10,940
New surface sources	126	9,020
Main transmission lines	284	27,610
Pumping facilities	365	33,260
Treatment facilities	304	39,330
Ground level reservoirs	193	20,340
Elevated storage tanks	304	20,720
Distribution systems	358	33,870
Total*	815	64,610

*The total does not equal the sum of the individual items since many facilities reported needs in more than one category.

The Manchester Report on Activated Sludge Treatment

(Corrections to Picture Captions)

In the "Report from Abroad" entitled "The Manchester Report" (W&SW, Feb., 1956, p. 89) an obvious discrepancy has been pointed out between the statements of the captions on page 90 and the text of the article.

To correct this error the caption for the lower picture on page 90 should read: "Simplex plant using high-intensity cones showed the best efficiency in parallel operation with other types of aeration."

Similarly, the caption for the upper picture should read: "Bio-aeration section of Davyhulme plant uses paddle wheels to both move and aerate the sewage, at the same time keeping froth to a minimum. This section of the plant was reported to be between the Simplex plant and the diffused air plant in efficiency."

To remove any possible doubt as to the relative efficiencies of the three units as operated in parallel at the Manchester Davyhulme plant, brief details of the essential data are summarized from the text as follows:

Plant Effluent	B.O.D., ppm	Power Used, hp/mg
Simplex	18.1	28.8
Bio-aeration	22.7	38.8
Diffused air	24.4	50.7

A Problem in Old Hydrant Replacement

And How It Was Solved Eventually

by HERMAN H. WINTER
Superintendent of Water
Monson, Mass.

THE WATER main from the reservoir to the town of Monson, Mass., a 12-inch main, had on it two 60-year old Ludlow hydrants which had been installed without a gate valve in the hydrant branch lines. Just as the strength of a chain is determined by its weakest link, the water supply for the entire town—the homes, schools, industries, hospitals—was dependent on these two now obsolete hydrants.

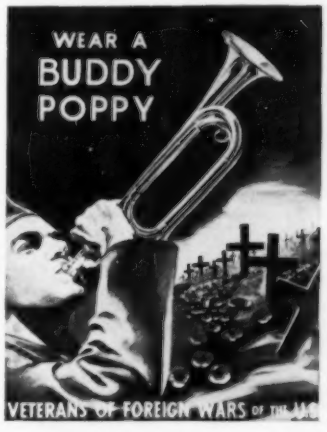
Even minor servicing of these hydrants could not be accomplished without shutting water off from the entire town. I would sometimes wake up in the night with nightmare thoughts of what might happen should one of those hydrants "let go" through sheer old age breakdown or be broken off by some wandering automobile.

I had a neat problem on my hands. I sought and got lots of advice, but none of it told me how to replace the obsolete hydrants with new ones without shutting off the water—and this was the high-pressure supply main.

How the Problem Was Solved

How the job of installing replacement hydrants and shut-off valves was done is told in the photographs.

The first photo shows the old Hall tapping machine in place just above the flange of the barrel of the hydrant riser pipe, ready to drill a 1¼-inch hole. The hydrant stem is in place. The hydrant, of course, is closed, the barrel dry.



Through this hole, by means of a funnel, the base of the hydrant was poured solid with Tegul mineral lead (see second photo).

A tripod was then rigged up, a hitch taken on the hydrant and, after loosening the flange bolts almost to the end of their thread, the barrel was separated from the base far enough to peek in to make sure that the mineral lead pour was complete and without any "holidays." If for any reason the seat was not secure everything could have been drawn right up snug again with the nuts caught by about three full threads apiece.

After finding everything as planned, the bolts were removed and the hydrant raised high enough to cut the stem. Hydrant, barrel and stem were then lifted out of the way. Using a fresh gasket and a blind flange, the old hydrant connection was sealed off. Only then was it possible to heave a sigh of relief.

With the old hydrant connection now sealed off with a blind flange (left center of third photo), the new hydrant was installed under pressure with a 12″ x 12″ x 6″ Mueller tapping sleeve and valve, as shown at the right of the same picture.

Some Recent Experiences in Taste and Odor Control*

by A. Y. HYNDSHAW

Mr. Hyndshaw is Research Chemist, West Virginia Pulp & Paper Co., Tyrone, Pa. In this paper he points out that overdosing with activated carbon is only an emergency measure and should be continued as routine only after careful study of the conditions requiring it.

IT HAS been said that activated carbon will control any type of taste and odor found in a water supply, provided sufficient quantities can be added. Although this statement credits activated carbon as being a panacea for correcting taste problems, the practice of indiscriminate overdosing with carbon is not recommended as a regular treatment. Rather, it should be practiced as an emergency means to buy time until the situation abates or the carbon application can be coordinated with the plant treatment.

Taste and odor conditions arising from runoffs or accidental pollution frequently necessitate the use of these extraordinary measures for maintaining a palatable water. However, conditions of this type generally persist for a relatively short time and the good will maintained by providing the consumers with palatable water justifies the cost of the treatment.

A city in Iowa can be used as an illustration for this type of problem. Here, an unpalatable water was caused by a spring runoff. For this situation, an emergency treatment using approximately 25 ppm carbon was put into effect. This treatment reduced the odors in the water from a threshold odor number of 90 to a threshold number of 5. Moreover, this treatment enabled the plant to produce a water that was within the palatable range. It is significant to note that this relatively high dosage of carbon (25 ppm) was necessary for only about five days, after which a palatable water was maintained even though the dosage of carbon was reduced to about 5 ppm.

* A paper presented before the New York Section, AWWA, and released for publication in Water and Sewage Works.

While the use of high dosages of carbon is justified for emergency cases, growth in the use of activated carbon in the water treatment field must depend upon sound economic principles. Consequently, where continued use of excessively large dosages of carbon may be indicated (that is, where tastes and odors may be of a continuing nature), a study should be made to determine the most economical means for controlling tastes and odors.

Influence of Treatment Chemicals

The research group of the author's company, continually striving to find the most economical method for applying activated carbon, has found that tastes and odors in water supplies can be influenced by certain chemicals which are added during the purification procedure. In some instances such influences have been beneficial, but there have been other occasions where an adverse effect has been noted. Often a thorough study of the problem will show that a simple modification to the method for applying the chemical will lead to a more satisfactory and economical means for controlling the taste and odor.

For a discussion of the influence of chemicals on the adsorptive qualities of activated carbon, two types of chemicals are considered, as follows:

1. Chemicals used for softening (for example, lime and soda ash).
2. Chemicals used for disinfection (for example, chlorine).

Frequently when lime has been added to the water ahead of the carbon, subsequent adsorption of the taste and odor bodies becomes difficult. This effect is ascribed to the lime altering the characteristics of the acidic taste and odor bodies present so that they are more difficult to adsorb on the carbon.

In general, it has been found that the best conditions for adsorption by activated carbon are obtained for waters having a pH value of 9.0 or less.

A midwestern city is used to illustrate this effect of lime upon adsorption by carbon: Lime softening chemicals were added in the first rapid mix; alum and carbon were added in the second rapid mix. During a spring runoff, the raw water had a threshold odor number of 30, and the addition of as much as 50 ppm of activated carbon was not producing a palatable water. The finished water had a threshold odor number of 22.

Reversing this sequence of addition of chemicals so that carbon and alum were added first, resulted in a palatable finished water (threshold odor No. 5). Moreover, even though the raw water conditions had remained the same, this change made it possible to reduce the carbon dosage from 50 ppm to 18 ppm and still provide a palatable water to the community.

Influence of Disinfectants

As an illustration of the influence from chemicals used for disinfection the following is a brief review of the

TABLE 1

Effect of Carbon Dosage on Odor Removal from Raw Water

Carbon Dosage, ppm	Threshold Odor Number	Odor Removal, %	Type of Odor
0	22	0	Fishy
10	7	68	Fishy
20	5	77	Fishy
30	4	82	Fishy
40	4	82	Fishy

results of a study made at a plant in eastern Pennsylvania where the chemical (chlorine) used for disinfection had an adverse effect upon the odor concentration in the water.

A threshold odor survey at this plant indicated that the carbon treatment reduced the odors in the water from a threshold number of 40 to a threshold number of 7. However, subsequent chlorination changed the characteristic of the odor from a fishy to a woody type odor, and the intensity of the odor of the finished water was doubled; that is, raised to a threshold odor number of 14. As a consequence, the water was considered unpalatable. (All samples were dechlorinated before odors were observed to avoid any masking effect from the chlorine.)

The first laboratory studies sought to determine whether the odors in the raw water were of the type that were difficult to remove. Raw water to which no other chemical had been added was treated with various dosages of carbon (Table 1).

These results showed that without interference from other chemicals approximately 20 ppm carbon would reduce the tastes and odors in this supply to a palatable level; that is, threshold odor number 5. Through experience, the laboratory has learned that carbon is approximately twice as effective for plant runs as indicated by laboratory experiments. Consequently, for the plant run a dosage of 10 ppm was suggested, which dosage was well within the economics for producing a palatable water in the plant. However, a water plant must disinfect the water so that it will be "safe for human consumption." Therefore, before proceeding with a plant application of carbon, laboratory studies were conducted to determine a form of treatment that would provide the necessary disinfection as well as furnish a palatable water.

The next studies sought ways to co-ordinate the chlorination step with the activated carbon treatment so as to obtain the maximum benefits from each.

It has been reported that when chlorine is used for taste and odor control, the best effect is obtained by carrying the chlorination to a point beyond the dip point of the curve.

For this laboratory study, chlorine was added to half-gallon samples of raw water, using the dosages shown in Table 2. The chlorine was allowed to remain in contact with the water for 19 hours, which length of time was selected because it was a convenient overnight period. Moreover, it was felt that the ultimate reaction from the chlorine would be obtained by this contact period. The residual chlorine for each sample was determined at the end of this period and the data was plotted on a graph using the applied dosage of chlorine as the ordinate, and the chlorine residual as the absicissa (Fig. 1). Inspection of this graph indicated that the dip point was just beyond the applied dosage of 2.0 ppm.

Threshold odor determination of various samples treated for this study showed that chlorine, when applied in less than breakpoint dosages, increased the intensity of the odor approximately 28 per cent. When the chlorine dosage was increased to obtain the dip point, the type of odor was changed from a fishy to a woody type, and the intensity of the odor was reduced by approximately 50 per cent. However, this reduction was not in itself sufficient to produce a palatable

TABLE 2

Effect of Chlorine Dosage on Odor Removal from Raw Water

Sample No.	Chlorine Applied, ppm	Chlorine Flash[a] Residual, ppm	Chlorine 5-Min.[a] Residual, ppm	Threshold Odor Number[b]	Type of Odor	Odor Removal, %
1	0	0	0	14	Fishy	....
2[c]	0	0	0	14	Fishy	0
4[c]	0.50	0.02	0.09	18	Fishy	28[d]
6[c]	1.00	0.03	0.14	18	Fishy	28[d]
9[c]	2.00	0.01	0.07	7	Woody	50
11[c]	3.00	0.37	0.50	7	Woody	50
13[c]	5.00	1.40	1.70	7	Woody	50

[a]Contact time of chlorine and water was 19 hours
[b]All samples dechlorinated before determining odor concentration
[c]Samples treated with 1 grain per gallon of alum
[d]Odor increase

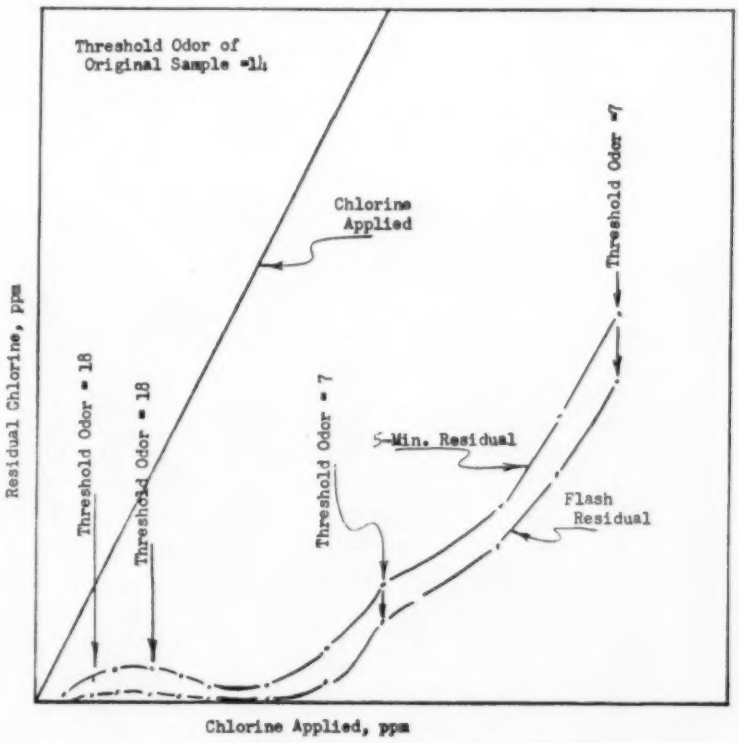


Fig. 1—RESIDUAL chlorine obtained versus applied chlorine dosage (19-hour contact)

TABLE 3

Odor Reduction by Use of Carbon in Conjunction with Chloramines for Disinfection

Treatment		Chlorine-Ammonia Ratio	Threshold Odor Number	Type of Odor
Alum, gpg	Carbon, ppm			
0	0	....	14	Fishy
1	10	....	5	Fishy
1	10	6:1	5	Woody
1	10	4:1	5	Woody
1	10	2:1	5	Woody
1	10	1:1	4	Woody

water. Subsequent studies indicated that the newly formed odor (that is, the woody type) was more difficult to remove by activated carbon than the one found in the raw water (that is, the fishy type).

When chlorination results in the formation of malodorous chlorinated compounds, ammonia can be added ahead of the chlorine to prevent this immediate reaction of chlorine and the taste and odor bodies. The next laboratory experiments studied this effect.

Chlorine-ammonia ratios were used varying from 1:1 to 6:1. After carbon treatment, the 1:1 ratio seemed to effect slightly better results insofar as odor reduction was concerned (Table 3). However, for this particular plant this amount of ammonia was not considered because:

1. This dosage of ammonia would not be economical.
2. There was some uncertainty as to whether this amount of ammonia might endanger the disinfection of the water.

Depending upon the amount of chlorine applied, pre-chlorination seemed to accentuate or "set" the odors in the raw water. Therefore, the use of chloramines at this plant seemed to offer a practical approach to supplying a palatable water to the community.

The foregoing studies lasted almost a week and many of the separate studies were made on different days. Since the character of the raw water could change from day to day, there existed possibilities that some of the influence attributed to treatment might actually be due to variations in the raw water. Therefore the entire study was repeated using a single sample of water for all tests.

The results of the second series of studies confirmed the preliminary investigation in that:

1. Without the presence of interfering chemicals, carbon would reduce the tastes and odors in the raw water to a palatable level.
2. Chlorine, when applied in less than breakpoint dosages, accentuated the odors. When applied in sufficient quantities to exceed the dip point, the odor was reduced by 50 per cent; however, this reduction using chlorine alone was not sufficient to bring about a palatable water.
3. Chlorination changed the basic odor to one which was more difficult to remove by a subsequent application of carbon than the odor found in the raw water.
4. Chloramines could be used effectively at this plant because they did not interfere with the taste and odor removing properties of carbon.

Some time after this work had been completed, it was realized that the experience might be utilized as the basis for a different approach; that is, application of free residual chlorination after carbon treatment. For example, if active carbon reduced the threshold odor number from 14 to 6, and free residual chlorination still accomplished a further 50 per cent reduction, the final water would have a threshold odor number of only 3. Such a combination might provide a finished water well within the palatable level, as well as an economic use of both carbon and chlorine.

Summary

Briefly, this paper suggests that when a taste and odor condition develops suddenly and without warning, an emergency application of excessively large dosages of carbon is justified in order to maintain a palatable water. However, when more chronic taste and odor problems of lasting duration prevail, plant conditions should be studied so that a savings for all of the chemicals can be obtained by coordinating the chemical treatment at the plant.

Thus, experiments have shown that (a) adding carbon ahead of the lime in a softening plant resulted in a more effective removal of taste and odor bodies, and (b) in another plant modifying the method for disinfecting the water enabled the operator to provide a palatable water to the community.

Jeep Power Takeoff Makes Valve Turning Easy

Efficiency and economy mark the Arnold Engineering Development Center's use of a jeep "faucet turner" to control the massive flow of cooling water required by the test facilities at this Air Research and Development Command installation. Special electrically-operated valves were first considered; then a special power unit. But the final solution cost less than $100, and it's working fine.

The master valves, controlling a 125,000-gpm flow, can be turned by hand, but require 4,980 turns, or eight hours of work for opening or closing. A simple universal joint and a telescoping shaft—connected to the jeep's power takeoff unit—now hustles from one valve to the other spinning them open or shut in less than 11 minutes.

San Francisco Getting Increased Water Supply

The job of cement lining "in place" the entire 47½-mile San Joaquin Pipeline No. 1 recently was completed by Pipe Linings, Inc., for the Public Utilities Commission of the City and County of San Francisco, Calif. It is believed that this is the longest single pipeline ever cement-mortar-lined "in place." The proect was started in the summer of 1952.

The pipeline, of 58½-inch average diameter steel pipe fabricated in 30-foot lengths and originally laid in 1932, was designed to carry 62 mgd across the San Joaquin Valley from Oakdale Portal on the eastern side to Tesla Portal on the western side. It is an important segment in the Hetch Hetchy Aqueduct, which runs from Hetch Hetchy Dam in the Sierra Nevada to Crystal Springs Dam on the Bay Peninsula.

Preliminary tests showed that the newly-lined pipe may increase San Francisco's daily water supply capacity by at least 14 million gallons.

SEWAGE WORKS PRACTICES

Trickling Filters

Series 2 — Part 6

by DON E. BLOODGOOD

Mr. Bloodgood is Professor of Sanitary Engineering, Purdue Univ., Lafayette, Ind. In this series, he discusses *Sewage Works Practices* in the form of short course lectures. These are designed to assist plant operators, students, and all who wish to review fundamentals in this field.

IN THE ARTICLE on trickling filters in the first series of these papers* there was only a brief summary given on the reportings of others. This current paper is devoted exclusively to the previously published material on the rates of application to, bacterial growth on, time of passage through, size of media in, rates of removal by, and ventilation of trickling filters.

It is always a good plan to have knowledge of the opinions of prior workers when undertaking to understand a particular process.

Treatment Obtained at Different Depths

Buswell[1] compiled in 1928 quite a detailed historical account of trickling filters up to the time of his writing. He wrote that, "Although much has been learned about the theory and operation of the sprinkling filter in the past 25 years, many of its interesting problems are still awaiting solution. One of these problems concerning which there is a difference of opinion, is the determination of the relation of the depth of the filter to the degree of purification."

Buswell reported extensive studies and concluded that no great benefit was obtained by having filters deeper than six feet. In the next quarter century after he made the foregoing statement, filters have been built with depths greater and less than the six feet that he recommended. This statement is not a contradiction and is only made to bring out the point that there is still a question in the minds of some as to what the correct depth should be. Buswell took samples at different depths in the filters. The analyses made on the

Water & Sewage Works, 101, 193, (Apr. 1954).

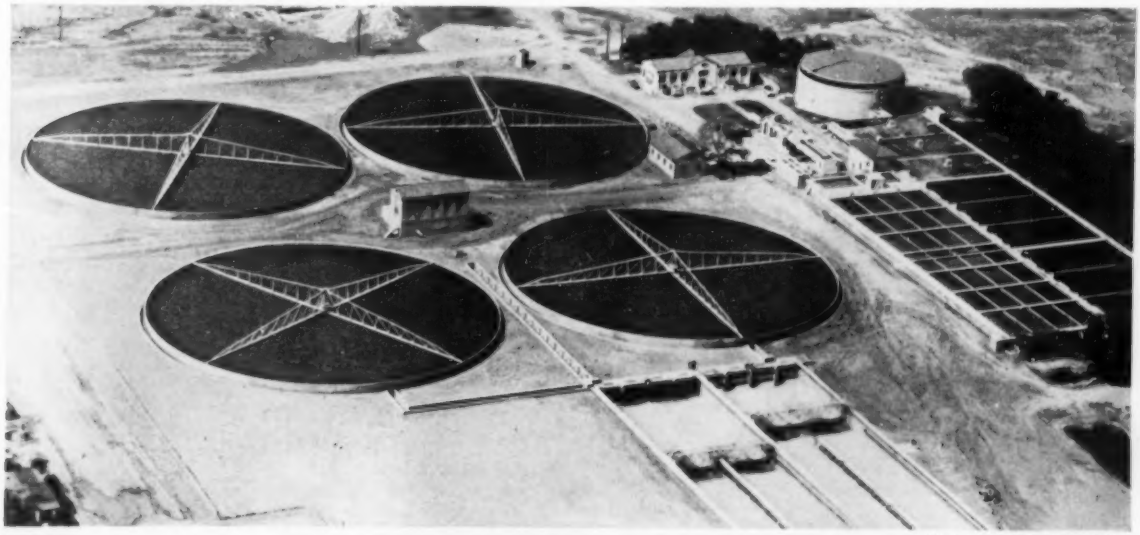


Photo courtesy Dorr-Oliver

TRICKLING FILTER distributors at El Paso, Texas, sewage plant are 220 feet in diameter, among largest ever built

MEDIA on 10-foot deep filter at Mansfield, Mass., plant of Hercules Powder Co. passed 4½-inch square opening and was retained on 3-inch round opening. Side walls are of wood stave construction

samples were to determine the progress of nitrification in the filters. There were some B.O.D. tests made, but not enough to make it possible to draw any definite conclusions.

Smith[2] made studies at Rutgers taking samples at different depths, but no record could be found as to what the depths actually were.

Rudolfs'[3] work, reported in 1923, showed the results in nitrification that were obtained at different depths. In his paper he had this to say: "And it would be reasonable even to assume that sewage which flows more slowly over active film surfaces with greater surface contact would undergo greater chemical change, than a larger volume flowing more rapidly. The amount of chemical change per unit volume is a function of the time and surface of the liquid exposed to active film."

Wilson and Hamlin[4] made studies with a 5-foot deep experimental filter. They show that there was considerable difference in the degree of purification obtained when the filter was dosed at different rates.

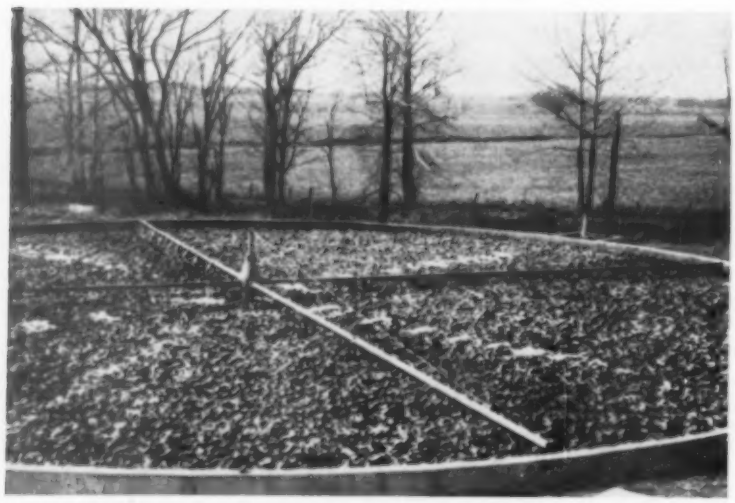
Butterfield and Wattie[5] used particular cultures of bacteria in studying removals with laboratory filters 22 inches deep made up of ¼- to ½-inch diameter gravel. The tubes were 2 inches in diameter. They used synthetic sewage and it is believed that it had a B.O.D. of 106 to 193 ppm. The results that they report are worthy of being repeated and so are given in Table I. These same data will be used later to demonstrate the removals obtained in shallow filters.

Not all workers have believed that recirculation on filters increased the contact time between stones and sewage because Horton et al.[6] has written: "Increasing the recirculation rates decreases the time of contact between the sewage and the gelatinous material in the filter bed, and consequently, decreases the amount of purification."

Allen et al.[7] operated two experimental filters. "One was a single filter operated at 60 gallons per cubic yard per day; the other was an alternating double filtration unit operated at a rate of 240 gallons per cubic yard per day." In this work samples were taken at different depths in the single-stage filter.

Phelps[8] has made statements regarding the purification rates in trickling filters. He has said: "The B.O.D. in dissolved form is the most difficult to remove and requires protracted intimate contact with zoogloea for extraction. The mass of the zoogloea in the bed and in sloughing, as well as the extent and duration of contact, are dependent on the hydraulic rate of passage of the liquid medium through the bed. Obviously, there must be some limit to the quantity of B.O.D. which can be assimilated by the biological life of the bed. The limiting B.O.D. load, then, must be a function of the rate of biological oxidation and storage capacity for accumulation of B.O.D. within the bed. Obviously, also, the size of the medium (surface area per cubic foot) is a factor in the storage capacity." He expresses the effectiveness of a trickling filter by the equation

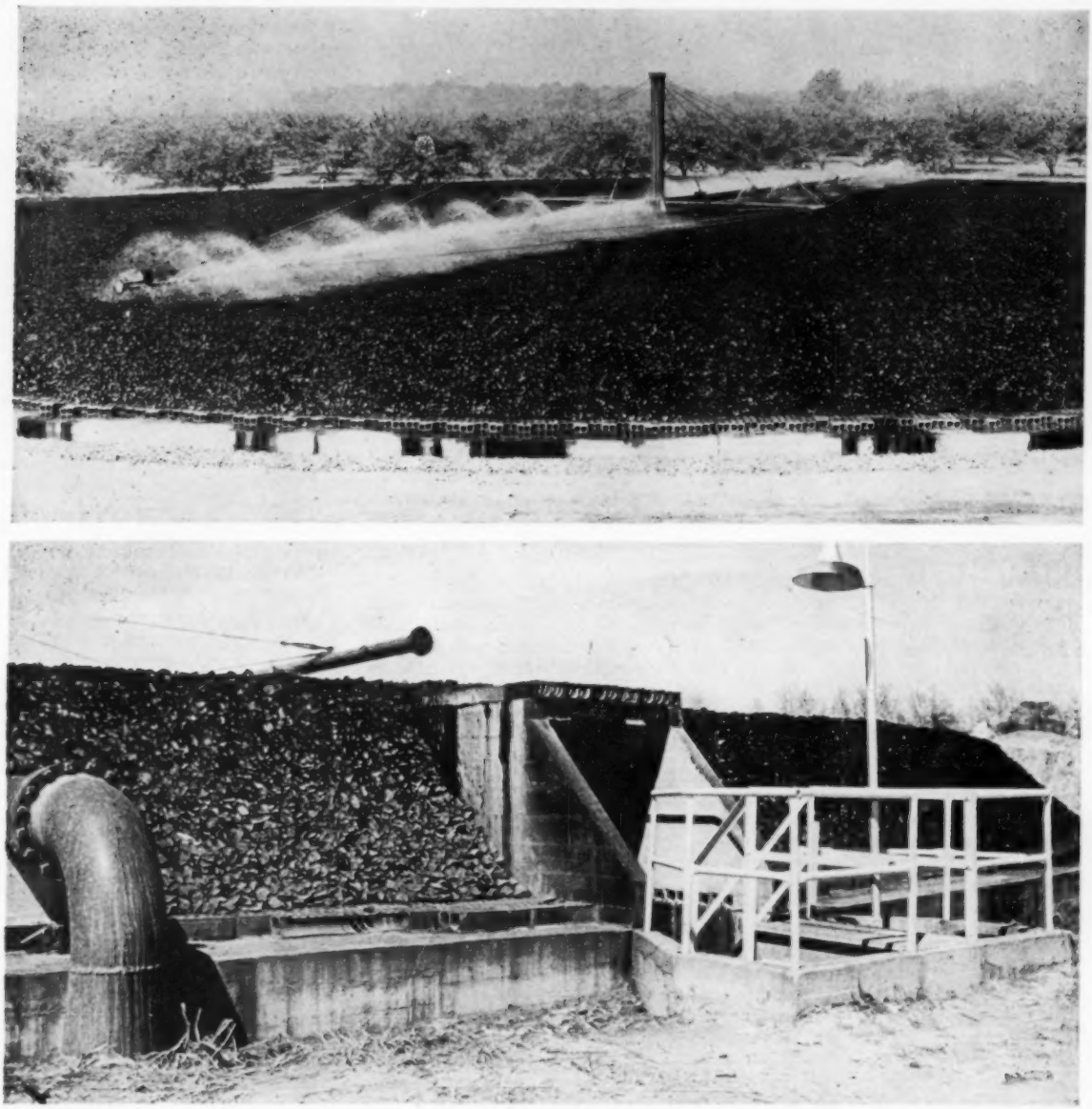
$$\frac{L_D}{L} = 10^{-KD}$$



SMALL trickling filter at an Indiana sewage plant is typical of many across the country.

TABLE I
Removals from 22-Inch Laboratory Trickling Filter
(after Butterfield and Wattie[5])

Culture 86		Culture 87	
Flow, mgad	B. O. D. Removal, %	Flow, mgad	B. O. D. Removal, %
0.34	71.1	0.39	78.6
0.92	52.1	0.75	62.7
1.21	57.1	1.22	50.0
1.80	49.1	1.78	35.8
2.22	43.1	2.25	40.5
2.68	38.6	2.73	35.6
3.17	32.6	3.28	29.8
3.70	22.7	3.78	31.0
4.51	23.2	4.51	24.5
5.37	14.2	5.00	29.2
6.26	16.0	6.07	27.6
7.46	21.2	—	—



LARGE 5-foot deep filter at Bristol, Pa., plant of Rohm & Haas Co. has no side walls and large tunnel (lower photo) to obtain maximum aeration as liquid flows over media surfaces

where L_D equals the removable B.O.D. remaining at depth D, L equals the total removable B.O.D., D is depth, and L_D/L is the proportion of the total removable fraction remaining in the passing liquor at depth D. K is a constant: for low-rate filters, Phelps says that it is 0.175, and for high-rate filters it is 0.1505.

Grantham et al.[9] reports removals obtained at 2-foot intervals in an 8-foot filter being loaded between 2.2 and 7.0 mgd. Different media were used (1½- to 2½-in. slag, wood block, wood slat, Brookville limestone, and Chattahoochee River gravel). He states that these tests substantiate the Velz *Basic Law* that "The rate of extraction of organic matter per interval of depth of biological bed is proportional to the remaining concentration of organic matter measured in terms of its removability."

Keefer[10] has compiled considerable data on the degree of purification accomplished at different depths in a filter under different loadings. The loadings ranged from 2.68 mgad to 16.39 mgad. Samples were taken at 2.0-, 3.75-, 5.5-, and 7.25-foot depths. Tests were run on both settled and unsettled samples.

Film Growth

Gaultier[11] was interested in trickling filter operation and was concerned with obtaining information that would show the importance of the size of media, the volume of film formed, the amount of air required for ventilation and the time of contect between sewage and media.

Wishart[12] was interested in the amount of film that forms on the media. He used primary and second-

SPRINKLING FILTER with fixed nozzle distribution has tendency to ice up between spray pattern during severe cold

ary filters and he reports considerable film on the surface of the primary filter and very little film on the surface of the secondary filter. He observed further that when the filters were switched the growth on the surface of the filters also changed, with the growth on the primary filter always being the greater.

Heukelekian[13] made a study of film growths and he has recorded the weights of film under different conditions. He does not give information, however, on the amounts of film at different depths. In another article[14] in the same series he reports that there is about 2.5 grams of film per kilogram of stone.

Roberts[15] also was interested in the amount of film found on filter stones. The abstract of his article does not say whether he obtained information on the quantity of film at different depths.

Tomlinson[16] made parallel observations on a single filter and on two other filters operated as alternating double filters. The alternating double filters were operated at two or three times the application rate on the single filter. The fungal growth was reported to be greater in amount in the alternating double filter as it extended to about 3 feet below the surface, whereas on the single filter the fungal growth was confined to the top of the filter.

Ventilation

Levine[17, 18] in his experiments on filter ventilation showed definitely that elimination of bottom ventilation resulted in a rapid decrease in the purifying efficiency of a filter.

Dekema[19] experimented with deep enclosed artificially ventilated filter beds and compared the results with those obtained on an ordinary open filter. In his conclusions he stated: "The results indicate that the enclosed ventilated filter was able to substantially treat to the same degree of purity slightly more than 2.15 times as much of the same sewage per cubic yard of media as the open filter."

Reid[20] in his writing said: "The efficiency (of a trickling filter) may be increased by the addition of forced draft air or by the regulation, within certain limits, of the recirculation flow."

Hunter[21] reports on an 18-foot deep enclosed filter with air taken in at the top by a fan. He says that when the fan was shut down for three weeks the effluent deteriorated. Furthermore, he says that four years of comparative operation data showed that the enclosed filter treated twice as much sewage per cubic yard of stone as did an open filter.

Chase[22], in a general paper on trickling filter operation, says: "On the whole, the evidence seems to indicate that neither forced ventilation nor porous filter walls are essential."

Time of Contact with Media

Rudolfs[23] in experiments with stone, slag and gravel concluded that the time of contact with the media did not seem to be of much importance. The filters were 5.5 feet deep, were dosed at 1.96 mgad, and it took 460 seconds for the sewage to pass through the filters in each case. In an article published sometime later[24], he said that slag media seems to do a better job and that roughness of the media seemed to be an important factor. The slag was found to hold about twice as much slime as stone or gravel. He also found that 1½-inch media removed 64 per cent, while 2½-inch removed 47 per cent.

Blunk[25] made studies on the rate of flow through a filter and concluded: "Except for the amount (sewage) which is retained in the filter, the sewage seems to flow through the filter in 20 minutes. The amount of sewage retained depends upon the surface of the material and the size of the stones used."

Goldthorpe[26], in conducting some experiments with high-rate filtration in 8-foot filters with 2- to 4-inch clinker, found that the contact time was 20 to 25 minutes at 10 mgad and 7 to 9 minutes at 20 mgad.

Schaetzle[27], in a discussion of trickling filters, says: "The original experiments in this country were by Hazen in 1892. In 1909 Rudolph Herring combined the three variables of bacterial surface, air supply and time of liquid passage through the beds into a formula giving the degree of purification. His reasoning was that the media size affects the area of bacterial film and both size of media and depth of filter are directly related to the time of passage."

It must not be assumed that the 27 references are all that are worthy of discussion. These have been selected because of some particular point that they bring out.

Discussion

Professor W.E. Howland of the Purdue School of Civil Engineering has taken the data presented by Keefer[10] and has analized them. When these data are plotted on semi-log paper and compared with the curves presented by Phelps[8] it is apparent that the Keefer data do not lie on a straight line. It would seem likely that the Keefer data substantiated the statement made by Phelps[28]: "It is likely that there are two different processes taking place in the trickling filter; coagulation and precipitation in the upper foot of the filter and biologic absorption and oxidation in the deeper part of the filter." However, the greater removals at the top may be due to the improved aeration or ventilation at the surface. It seems quite unlikely that aeration plays so important a part as to give the great difference in activity shown in the Keefer data. It must not be forgotten, however, that a number of researchers in the past have pointed out that they have found that improved ventilation has

increased the effectiveness of the filters with which they were working.

There has been no careful evaluation made of the amount of air necessary to give maximum performance.

Several of the researchers have done work with media of different material and sizes. The indications seem to be that the larger media are not as effective as the smaller sizes. There are indications that the rough surfaced media do the most work per unit of volume. There seems to be no definite proof, however, whether the rougher stone retards the flow through the filter or whether the stone is more effective because it can hold more slime.

Howland has written a formula that fits the data presented by Keefer. The Howland formula is:

$$\% \text{ remaining} = 75 \times 10^{-2y^1} + 25 \times 10^{-0.1142y^1}$$

$$y^1 = \frac{\text{depth of filter, feet}}{(\text{flow, mg per acre})^{\frac{2}{3}}}$$

This equation takes into account the two rates of removal. It would seem, therefore, that the time of retention in the filter is a function of the rate of application.

Time of flow through a filter, then, should be a very important factor in considering the possibilities for increasing the loads to be applied to trickling filters.

There seems to be some indication that there is a great deal more slime growth on stones at the top of the filter than there is at the bottom.

Summary

It is apparent that there has been considerable written about trickling filters, but that not all of the published information is in agreement. Furthermore, it would seem that additional information should be compiled in an effort to establish definitely certain basic concepts about the operation and behavior of trickling filters.

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PORTION of Jacksonville's enlarged and modernized sewage treatment plant

Jacksonville's Modernized Sewage Treatment Plant

An Item in Town's Look to the Future

by A. C. TURNAGE
City Engineer
Jacksonville, N. C.

PRIOR to WORLD WAR II, the town of Jacksonville, N. C., population 890, was the county seat of a typical southern farming district. With the exception of two small lumber companies, the town depended on local trade of farmers for its economic well-being.

With the outbreak of war, the U. S. government purchased land adjacent to Jacksonville, and constructed the largest Marine base in the world, Camp LeJeune, on the New River about 7 miles east of town. By 1950, the town's population had risen to 3,900, and by 1954 the expanded military program generated by the Korean police action pushed the population well up into the 13,000 bracket.

An example of the rapid growth of the town is reflected in the 1,848 building permits issued since 1950. This dynamic increase in population, in so short a time, presented Jacksonville's municipal government with many serious problems, the paramount one being sanitation. Existing sewage disposal facilities could not accommodate the influx.

By 1953, the original sewage disposal plant, with a capacity of about 600,000 gpd, was hopelessly overloaded. The steady arrival of Marines and their families, who took up residence off-base in the town of Jacksonville, only posed more problems for the city officials. Immediate action was taken to enlarge and modernize the sewage plant so that it could handle a greater population. The resultant plant, now in operation at Jacksonville, represents intelligent planning for the future by a forward looking city government.

Jacksonville's then existing sewage disposal plant consisted of one 45-ft clarifier, a trickling filter (standard rate), and one 45-ft digester. The treated sewage was, and still is, discharged into the New River.

The Modernized Plant

Working with these facilities, town officials and the engineering firm of W.F. Freeman & Co., High Point, N.C., designed a $400,000 addition, incorporating high-rate biological filtration. Now equipped to handle a population of 25,000, the essentially new plant was constructed by Crain & Denbo, Durham, N. C.

Backstopping the original equipment are two 45-ft primary clarifiers; one 80-ft secondary clarifier; a 15-ft grit remover, furnished by Infilco, Inc.; and a heat exchanger for the sludge control house. Floating covers for both digesters (one 45-ft in diameter and the other 55-ft in diameter) and the heat exchanger were supplied by the Pacific Flush Tank Co. of Chicago.

Pumping requirements for the plant are met with four 1,200-gpm sewage pumps and one 150-gpm sludge pump supplied by Fairbanks-Morse Co.; two 1,400-gpm Morris sewage pumps, and two positive displacement sludge pumps manufactured by the Chicago Pump Co. With the exception of the two positive displacement pumps, all pumps operate automatically.

Control of sewage flow is accomplished by use of eight HY-Q* flush

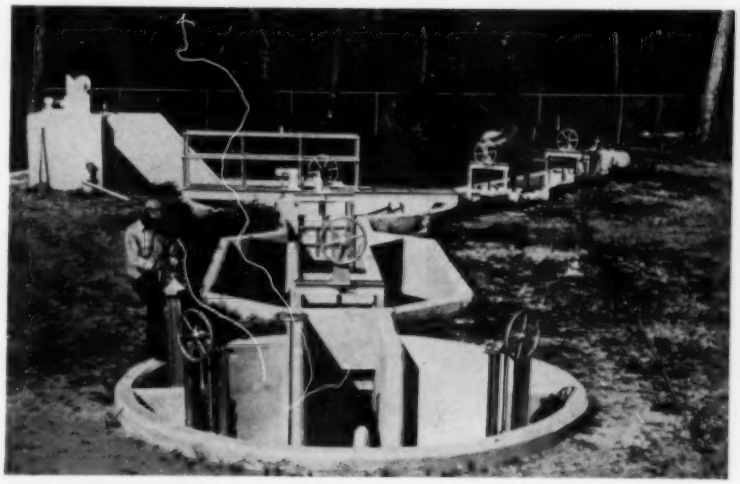
*HY-Q is a trademark of the Rodney Hunt Machine Co.

bottom sluice gates furnished by Rodney Hunt Co. of Orange, Mass. These gates range in size from 18 in. in diameter to 36 in. by 24 in.

Three 18 in. diameter HY-Q flush bottom sluice gates were installed in the distribution well; one 24 in. HY-Q gate was installed in the by-pass; two 30 x 24 in. HY-Q gates were installed in the by-pass chamber; and two 36 x 24 in. HY-Q gates were installed at the screen chamber. It is the authors opinion that these flush bottom gates represent the first basic sluice gate improvement in years.

A feature in this new patented sluice gate design is the fact that the frame has been lowered so that the opening is flush with the chamber or channel floors, thus eliminating the barrier required for many gates to seat against, or the deep pocket in which wedges must descend. This arrangement offers several advantages. For instance, there is less turbulence at the bottom, where head is greatest, so smoother flow is possible; there is no barrier or trough to accumulate silt and trash, thus easier closure is assured. This new flush bottom design causes the sewage to flow smoother without spattering. The gates are easier to operate and do not leak. In fact, the greater the pressure against the gate, the tighter it seals.

The gate carries on the bottom of the disc a heavy strip of flexible Neoprene. When the HY-Q design gate is closed, the Neoprene flexes and gives a "cushion closing" seal which compresses on the stop bar.



OVERALL view of bar screen, Infilco grit removal chamber, mechanical screen cleaner and shredder and distribution well in foreground

Treatment Process

Treatment at the plant consists of plain primary sedimentation, separate sludge digestion, trickling filtration and secondary sedimentation. Raw sewage enters the plant through two outfall lines, one 15 in. and one 18 in. in diameter. From the inlet chamber, the sewage moves through a bar screen with 2 in. openings, then to a circular degritter. The effluent from the degritter is partitioned equally to three primary clarifiers. These units also are round, with a central inlet well and peripheral weir and effluent trough. The clarifier effluent is pumped to a fixed-nozzle high-rate trickling filter which is operated at a recirculation ratio of about 1 to 4. One secondary clarifier is used for final settling, the effluent being discharged into the New River.

Sludge from the primary clarifiers, as well as filter humus, is pumped to the digesters, where it undergoes two-stage digestion. Sludge from the primary digester is recirculated through a heat exchanger that utilizes sludge gas. Temperature is held at 90° to 95° F. The secondary digester is not heated.

No chemical treatment is being used at Jacksonville, but it may become necessary to chlorinate during the summer months. Digested sludge is dried on open beds and the dried sludge is used on the town's parks and playgrounds.

Three operators are employed at the plant. Each man works a 12-hour shift for each of two days, then has one day off. Another employee of the town is capable of operating the plant when one of the regular operators is sick. This schedule was adopted after experimenting with several others. It has been very satisfactory, both from our standpoint and that of the operators.

The enlarged and modernized plant now has a 2.0-mgd capacity, and at the present time, is handling about 1,000,000 gpd winter and 1,500,000 gpd summer loading. The plant was designed so that in coming years, should the population take another sharp rise, an additional primary clarifier can be easily added, boosting the capacity of the plant to 2.67 mgd.

CLOSE-UP, showing features of the 24" x 36" Rodney Hunt flush bottom plant influent gate

TYPICAL sewer construction involving pipebedding with crushed stone

How A Sewer Contractor Cuts Handwork

Utah contractor adopts conventional machine on unconventional mounting to cut labor costs sharply

by RAY DAY

Mr. Day is a technical and scientific writer of prominence who travels widely and contributes articles of interest and value to the reader, as well as to his clients. This article could well result in lower bidding on sewer construction projects.

AN INGENIOUS Utah pipeline and sewer contractor, with a firm conviction about the type of mounting his excavating equipment should have, has practically eliminated expensive hand labor from extensive sewer construction activities under his supervision. Eldon Kloepfer, of the Logan, Utah, construction company bearing his name, is the man with the idea. How well it paid off can best be told by the following incident.

On a recent job, a lateral sanitary sewer line had to be cut through a point where a sidewalk, four high-pressure water lines, a gas main and two telephone cables intersected the ditch, all within 25 feet. Kloepfer's machine handled the assignment in less than one-half hour, without a single shovelful of hand excavation being turned.

Kloepfer got his idea when he saw a Bucyrus-Erie "Hydrohoe" demonstrated near Salt Lake City, and noted the unusual measure of control and flexibility possessed by the machine. Here was exactly what he needed for much of the tedious, time-consuming, expensive hand-labor work in many of his operations—particularly lateral construction.

Kloepfer turned his mind to the problem of how to mount the machine so it would get into many of the places where this type of work is being done. One of the most troublesome problems in the northern Utah area is the presence of marshy, quaking bogs where the

"HYDROHOE" starting one of the lateral excavations—the only machine that could tunnel under the sidewalks

groundwater table is high. These places can quickly mire a machine on conventional truck mounting. Why not pick the Hydrohoe up off its truck mounting and set it down on the rear bed of a war-surplus halftrack? The more Kloepfer thought of the idea, the more it appealed to him.

With the Hydrohoe purchased, Kloepfer put his plant into action. The mounting consisted of a war-surplus White half-track, which was picked up in excellent condition. A heavy steel bedplate was laid over the rear end of this machine, and the Hydrohoe, with its Ford engine and hydraulic pump equipment, was centered over the bed. The work was done in Kloepfer's shop by mechanics who ingeniously contrived a 10-bolt mounting. Should Kloepfer ever want to take the machine off the halftrack, he can replace it on its conventional truck mounting by loosening the ten bolts, lifting the machine over to the new mounting, and fastening it down again.

Idea Works Nicely

Kloepfer's idea has worked beautifully. He estimates that a labor force equal to at least 5 or 10 men has been eliminated from typical sanitary sewer construction contracts. The halftrack-mounted Hydrohoe has proved especially suitable for digging lateral ditches in those hard-to-get-at places. If both sides of a sidewalk are accessible to the ⅜-yard digging bucket on the machine, it can dig a trench quickly and easily *under* the concrete walkway, leaving enough dirt bridged to support the structure safely. Accompanying pictures show such an operation getting under way.

The controls on the Hydrohoe are exceptionally sensitive, and a good operator like Ralph Blotter, who runs the rig, can feel a pipline the minute the teeth come in contact. Accidental breakage of water or gas lines has been negligible in relation to the amount of work perfomed by the machine. And yet, according to Kloepfer, the machine has a very desirable power reserve which comes in handy whenever tough clays, gravel and other hard-to-dig formations are found.

It was recently necessary, for example, to dig through an old abandoned 3-in. steel line which was still in fair condition despite its long abandonment. Since there was no acetylene cutting torch on the rig at the time, the operator simply hooked into the pipe with his bucket and put the hydraulic retracting mechanism to work. The pipe was pulled out quickly and easily.

The unconventional halftrack mounting has absolutely whipped the marsh problem. During the winter months, when conditions underfoot are muddy and bad, Kloepfer's men have been able to take the machine into places impossible to reach with trucks. The Hydrohoe is sufficiently light so that the halftrack mounting floats its weight over the surface of the ground without miring, or even without excessive penetration into the soft footing. The machine has the ability to get into a job and get out fast.

On lateral work it is not uncommon for the machine to start from a property line, dig a trench under a sidewalk and curb, and out beyond all intercepting utilities lines to a sewer connection near the center of the street in about 30 minutes. The Hydrohoe with its operator and two men have installed up to 20 complete laterals in a shift's time. The only expense for this operation, aside from the labor and depreciation on equipment, is from 7 to 15 gallons of gasoline which the machine will use in a 9-hour shift.

The telescoping boom and other control features on the Hydrohoe,

BUCKET of the "Hydrohoe" starting under a sidewalk. Working from first one side and then the other, the trench is quickly tunnelled through

coupled with the unique mounting which lets the machine get in where the work is, has given Kloepfer a head start in bidding this type of work.

Other Equipment Used

Over the years Kloepfer has built up an impressive lineup of sewer and pipeline construction equipment. For heavier excavation on mainline trenches, where hard digging is a problem, Kloepfer has two Bucyrus-Erie 22-B dragshovels. For lighter excavation, he uses an Austin-Western Badger, along with the halftrack-mounted Hydrohoe. For backfill work, there is an International TD-9 and TD-18A tractor and a Caterpiller D7 bulldozer. An Austin-Western motor grader, on which a dozer blade is mounted, is used for backfill, as well as for road reconstruction work over certain areas through which pipeline work has passed. Kloepfer also has water wagon equipment, dump trucks, and pickups.

Importance of Two-Way Radio

The entire outfit has been completely equipped with Motorola two-way radio communication. This has helped greatly to boost general efficiency by keeping key men and crews in touch with each other.

Kloepfer Construction Co. is currently busy on a 25-mile sanitary sewer job which is being done in Salt Lake County for Sanitary Sewer District No. 1. The job includes vitrified clay, concrete and Transite pipe, from 4 to 12 inches in diameter. Average trench depths are 10 feet, with an 18-foot excavation maximum. Formations through this job have consisted principally of boggy, wet sand and hard, blue clays.

According to Eldon Kloepfer, all of his equipment has come in very handy in hurrying the work along, even with heavy ground water conditions. And one of the handiest machines of all is the halftrack-mounted Hydrohoe.

Kloepfer summed it up in a nutshell as he smiled and said: "Now that we have this machine and know what it will do, we wonder how we ever got along without it. We wonder what we'd do if we ever had to go back to the old hand-labor methods. No class of labor on a job is quite as problematical as hand labor."

Turtles Shut Off Water for Town

Two billion gallons of water at the doorstep and not a drop to drink.

That was the situation recently in Okeechobee, Florida — population 1,849 — after loggerhead turtles clogged pipes bringing water from the big lake into town.

While pumps were temporarily shut down for new pipe installations, the turtles crawled into the pipes and acted like stoppers. Crews worked all night to get the pipes cleared.

Sea Distillation Plant

One of the largest sea water evaporating and distilling plants in the world has been ordered from a Glasgow firm for installation at the Netherlands Antilles island of Aruba in the Carribbean, the British Information Service reports. It is capable of providing 8,000 tons of fresh water daily. The contract, worth about $3.5 million, was placed through a New York firm of consulting engineers.

Atomic Tests Planned in Sewage Treatment

Atomic energy for treatment of sewage is to be tested in Los Angeles, the first time nuclear radiation will have been applied to such use, according to a recent announcement.

"If successfully developed this new use of atom power might revolutionize present-day methods of sewage decontamination and disposal," Mayor Poulson declared.

The experiments will be carried out under the direction of Hyperion Engineers, a joint firm of Los Angeles engineers retained by the city to plan some $40,000,000 worth of improvements to the Hyperion Sewage Treatment Plant. The nuclear studies will be made without cost to the city.

The actual experiments in the use of atomic energy in sewage treatment will be carried out by the Nuclear Science and Engineering Corp., Pittsburgh. The tests will be made in the company's laboratories and at established nuclear reactors on samples of city sewage.

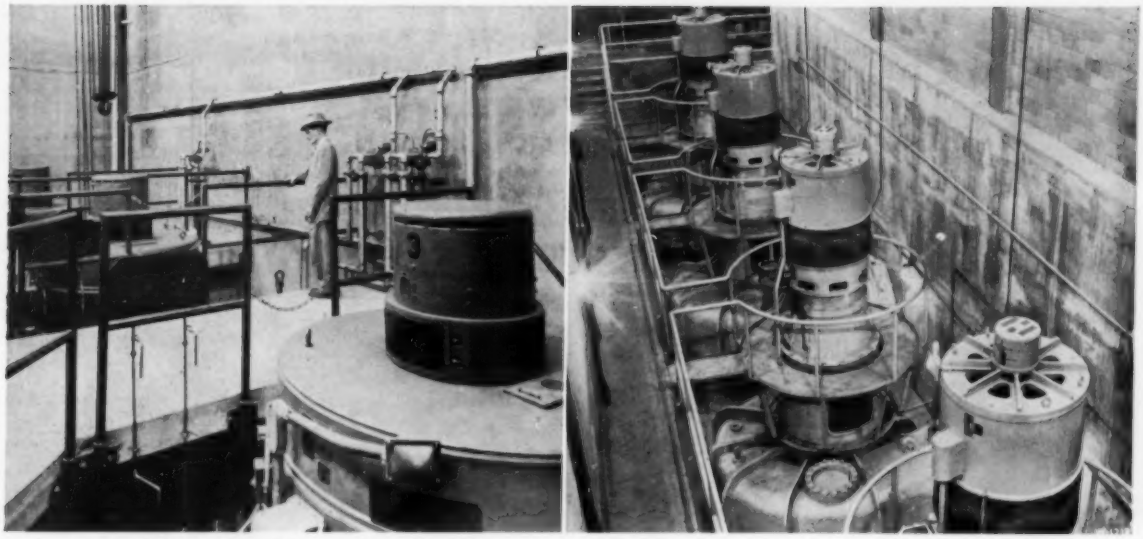
In addition, cost studies will be made of the new technique and compared to those of the present disposal process.

Hyperion Engineers is composed of the firms of Holmes & Narver, Inc.; Daniel, Mann Johnson & Mendenhall, and Koebig & Koebig.

Mural Brings Art To Sewage Treatment Plant

The first monumental mural on the exterior of a municipal building in the United States was exposed to public view in Coral Gables, Florida, recently. Painted upon the walls of a Coral Gables sewage treatment tank by artist John St. John, the mural depicts five epochs of the first 300 years of Florida history. The project had taken almost exactly one year.

A second section of the mural, to be painted on another tank, will depict events of Florida statehood.



MAGNETIC DRIVES provide multi-speed sewage pumping control at St. Louis (left) and Boston (right)

Automatic Flow Control

Sewage Plants Employ Multi-Speed Pumping To Meet Changes in Load

by H. J. MEEKER

The author, now enjoying retirement, was Vice-President in Charge of the Public Works Division of Worthington Corp., Harrison, N. J. In this article he describes installations of a unique device that allows infinite variation in pumping rate between pre-set minimum and maximum flows.

MANY PUMPING STATIONS in operation today that have an installed capacity equivalent to the flow of a good-sized river. Where large volumes of water are transported through pipelines, either downhill by gravity or pumped uphill to the point of use, the control of these flows becomes an important matter. It is necessary to provide facilities and a method for preventing damage from pressure surges that may result when the flow through a pipeline is suddenly stopped.

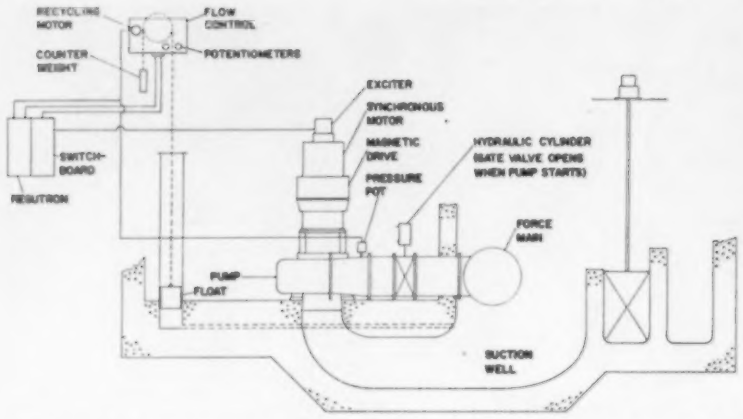
This is exemplified in pumping plants for water works and sewerage service, as well as in hydroelectric plants—all being subject to changes in load. So that the most efficient system can be obtained, the changes in the volume of the flow should be made as gradual as possible. To vary the water flow in the old days of steam pumps, the operator changed the engine speed at the steam throttle. When the electric age arrived, a variable-speed motor or combinations of several constant-speed units were used to meet the change in pumping loads. The synchronous motor, with its higher efficiency and improved load factor, offered many advantages. However, this type of motor could only be used in constant-speed pumping and therefore lacked flexibility.

Magnetic Drive Proves Its Value

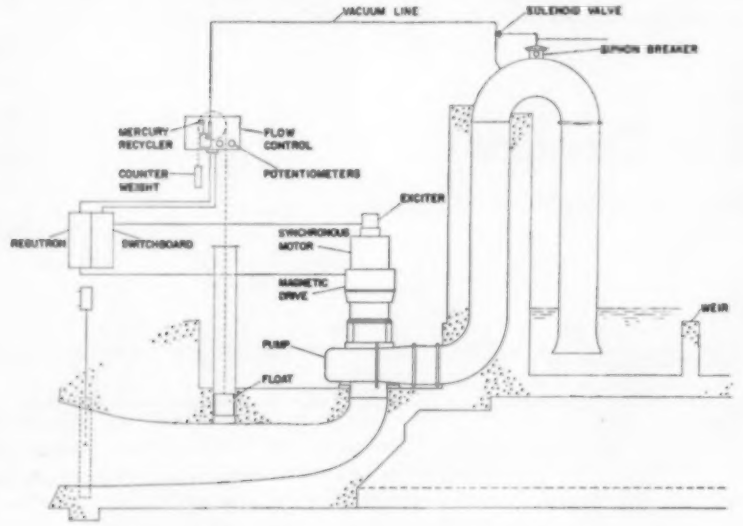
It was evident that a pumping unit having the advantages of the synchronous motor, and with some means of varying the speed of the pump, would provide an ideal unit for regulating the flow. The magnetic drive had been developed and used for many years, in various services. To our knowledge it had been used in one instance for low-head water pumping. However, it had never been used for sewage pumping until it was installed at the Nut Island sewage treatment plant of Boston, Mass.

The problem at this plant required close regulation of the level in the suction well, as the coarse solids comminutors are located between the grit chambers and the pump suction well. For proper operation of the comminutors, a regulation of three inches plus or minus from a normal level, with a flow from 20 to 270 mgd, was needed.

At that time no machine was available that would combine with the synchronous motor and the magnetic drive to automatically obtain the stepless regulation of pump speed for holding the suction well within the



RECYCLING flow control actuated from pressure on discharge when pumping through force main



RECYCLING flow control actuated from vacuum at siphon invert

desired limits. One was developed, however, and this pumping plant has now been in successful operation for four years. Since the author described this installation in an article published in the October 1949 issue of *Water and Sewage Works,* entitled, "First Magnetic Drives for Sewage Pumps," only the fundamental design of the flow control is described here.

Flow Control Unit

The flow control unit consists of a 14-inch diameter aluminum float which is raised or lowered by the water level in the pump suction well. It is suspended by a chain, riding on a sprocket wheel and having a counterweight on the other end. The sprocket wheel is attached to a horizontal shaft with a cam disc, rotating with the sprocket as the water level changes.

A potentiometer regulates the speed of the magnetic drive. Four of them (one for each unit) are located on shafts parallel to the main shaft of the flow control. Two potentiometers on each of the two shafts control the four pumping units. The motion of the cam shaft is transmitted to the potentiometers by a cam follower guided in the groove of the cam disc. Thus, the rotation of the disc gives a reciprocating motion to a rod hinged to the cam follower.

A rack on the rod engages two gears on the potentiometer shafts, resulting in a rotary motion of the potentiometers. This regulates the magnetic drive. Mercury switches mounted on the end of the main shaft, opposite the sprocket wheel, provide for automatic starting and stopping of the drive. They also operate indicator lights mounted on the panel board. Over-travel on the cam disc is provided to hold at maximum or minimum pump speed beyond the range of the speed variation. This is necessary to allow the level in the suction well to temporarily rise or fall beyond the operating range. In this way, the contact switches for starting or stopping successive units will function properly.

Unit Improvements Provide For Recycling

Since the installation of this unit at Nut Island, the general appearance of the flow control has been improved and new features included that provide for recycling and other special conditions. It is, of course, not always practical to hold the suction well level constant (or practically so), as is done at Nut Island.

Variations in the design of the cam disc to provide for lesser or greater speed variation and the amount of under- and over-travel, will meet some conditions without provision for recycling. Where conditions require wide variations in the suction well level, or the head against the pump discharge varies, recycling of the flow control is necessary.

Recycling is accomplished by changing the relation between the sprocket wheel on the main shaft and the position of the potentiometers operating the magnetic drive. The nature of the hydraulic problem determines how the recycling will be done. In some cases, the torque initiating the motion of the potentiometers is obtained from the float in the suction well; in others, by the variation in discharge pressure.

Other Installations of Flow Control

Other installations of the flow control unit have more recently been made in the sewage pumping stations of Camden, N. J., New Rochelle, N. Y., and St. Louis, Mo. Because the hydraulic problems in each case are different, the solutions are interesting and should be noted.

At the Camden plant there are no comminutors discharging into the pump suction well. The well is connected to a long sewer of 7-foot diameter. There are four pumping units, three of which are for maximum flow (similar to the Nut Island plant). The change in suction well level is 4.5 feet from minimum to maximum flow. Each unit operates over a range of

1.50 feet before recycling begins. The suction well level is at maximum at full flow with the three units in operation, and at the lowest level when only one unit is in service.

As the pumps at Camden and Nut Island discharge to sewage treatment plants at a fairly constant discharge head, the flow controls used are similar except for the recycling feature in the Camden control. This is accomplished by a 1/12-hp reversing motor mounted on the control. It changes the relative position of the sprocket wheel with the potentiometers at each 1.5-foot increment of suction well level.

When the maximum capacity of one unit is reached, the speed is immediately reduced, the second unit is started, and the load becomes equally divided between the two. Similar division of the load occurs when the third is placed in service. Thus, stepless control of the flow over the entire range prevents any sudden change in the rate of flow to the treatment plant.

Methods for Providing Recycling

To date the following three methods have been developed to provide recycling of the flow control; others may prove practical if the hydraulic problem warrants:

1. A reversing motor that changes the relative position of the float in the suction well with the potentiometers, automatically actuating the magnetic drive to obtain changes in speed.
2. A pressure pot with switch on the discharge side of the pump, which acts as a pilot to the recycling motor, independent of the suction well level.
3. A vacuum line from invert of discharge siphon and a mercury tube, providing power to operate the potentiometers for the magnetic drive. This device also operates independently of the suction well level.

Advantages of Flow Control

The advantages of automatic control for the operation of pumping plants are:

1. Reduced labor costs.
2. Ability to operate a plant having a wide variation at the rate of flow or pumping head at maximum efficiency point with one or all units in service with a minimum of over- or under-pumping.
3. Avoids sudden changes in rate of flow to sewage treatment plant.
4. Eliminates frequent on-and-off operation of plant, with resultant power inrush at starting. Another factor toward reduction in cost of power.
5. Maintains proper sedimentation of solids in sewage treatment plants.

The pertinent data on the pumping units at the installations mentioned in this article are given in Table 1.

TABLE I
Data on Pumping Units Described

Station	Units		Capacity, mgd*		Head Range, ft	Motor Size, hp
	No.	Size, in.	Min.	Max.		
Boston, Mass. (Nut Island)	4	48	20	90	8-10.3	200
Camden, N. J.	4	30	15	30	40-41	300
St. Louis, Mo. (River des Peres):						
Station No. 1	3	36	32.4	77.7	12-37	350
Station No. 2	4	42	13	53.8	53-66	700
New Rochelle, N. Y.	4	16	1.39	10.0	25-34.5	75

*Each unit.

Private Water District For Suburban Home Development

Many suburban home builders and real estate developers have wished for a public utility to handle water supply problems in their housing projects. A Michigan builder solved this problem by building his own water system and then giving it to the local government to operate.

Couchois & Miller, Haslett, Mich., began construction last spring of 400 homes, in the $15,000 range, in the suburbs of the small town east of Lansing, Mich. The firm built in the subdivision a water pumping station and distribution system designed to supply 600 homes.

After completing 200 of the homes, the builders turned over the water system to Meridian Township officials, without charge. The system cost $90,000. This amount will be charged against the cost of improving the lots in the subdivision that will benefit by the water district. Township officials assumed responsibility of the new water district's operation and maintenance.

The water system includes two 10-inch wells pumped by two Deming vertical turbine pumps, a network of water mains and a 30,000-gallon elevated storage tank. Before the elevated storage tank was completed, the pumps filled a 3,200-gallon pressure tank that served the water needs of early home occupants. Now the pumps, each of 250-gpm capacity, fill the storage tank to serve approximately 50 customers of the water district.

The distribution system includes both 6-inch and 8-inch mains, with house connections to the property line for each lot. For extra measure, the contractor also installed fire hydrants at appropriate intervals.

From the builder's standpoint, the plan holds several important advantages. The prospect of "city water service in the country" without the expense of wells, septic tanks, etc., attracted economy-minded home buyers. The improvised pressure tank system gave first occupants good water service from the start. Deeding the system to the local township relieved the builder from the responsibility and expense of operating and maintaining the system indefinitely.

According to L. T. Miller, township officials were also very happy with the arrangement. They owned a debt-free water district, named Meridian Township Water District No. 2. Water District Supervisor Barney Ward estimates the new district will begin to show a profit in about three years. The initial cost of $30 to set a meter for each customer is the township's only capital expense.

Homeowners in the subdivision are benefiting, too. The first quarterly bills sent to subscribers list rates of $0.52 per 1,000 gallons up to 8,000 gallons, $0.30 per 1,000 for the next 8,000 gallons, and $0.16 per 1,000 gallons for all over 16,000 gallons. These rates are 50 per cent lower than the rates of Meridian Township's publicly-constructed District No. 1.

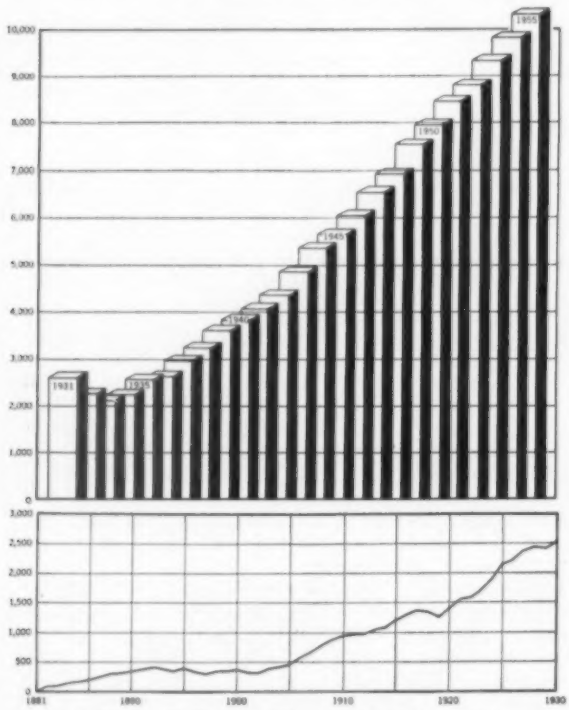
The eventual cost of such a system is passed eventually to the home buyer, but it is a bargain. The cost of the water system divided among 600 users amounts to $150 each. This saves the greater cost of drilling separate wells and installing pumping equipment and a septic tank.

THE EDITOR'S COMMENTS

AWWA's "Stairway to the Stars"

This issue is timed to reach subscribers just before or during the 1956 convention of the American Water Works Association in St. Louis, Mo., May 6-11. It seems fitting, therefore, to devote this page to a bit of AWWA history at a time when this now venerable association is celebrating its 75th Anniversary and Diamond Jubilee Convention in the city of its birth—St. Louis, 1881.

The accompanying chart, the upper portion of which also appears on the front cover, pictures the association's membership growth from its beginning to the present. We chose to call this chart AWWA's "Stairway to the Stars"—if not that, then at least to its Diamond Jubilee Anniversary year 1956. For this chart we are indebted to AWWA's staff, which, instead of providing us with the year by year membership figures asked for, produced the chart for joint use by the association and ourselves. We dare say that our artist would have done a less effective job. The chart tells more history than first glances reveal. This we will say something about later.



AWWA's 75 Year Membership Growth Record

Seventy-five years ago, in 1881, there were fewer than 1000 public water supply systems in this country and water treatment was little known and less practiced. Where the idea of forming an association of professional water works men originated is not known, but on Jan. 18, 1881, a letter from Wm. C. Stripe, Sup't. of Water Works, Keokuk, Iowa, was addressed to a number of water works superintendents, suggesting the holding of "a convention of superintendents of western water works". The result was a meeting of 24 waterworks men on March 29, 1881, at Washington University in St. Louis, Mo., and then and there was born the American Water Works Association. As the charts show, from this 24 charter member group, the association has grown to a 1956 membership of better than 10,000—the world's largest water supply organization. The first president was Col. J. T. Foster of Chicago.

Twenty-five years later the membership was still less than 1000. During its first 32 years the activities of AWWA consisted principally of an annual convention and publication of one volume of "Proceedings" each year. In 1912 AWWA was incorporated in the State of Illinois, and still is. In 1914 the organization of Sections of the Association came into being. The first section formed was the New York-New Jersey Section. The second was the original Iowa Section. Today there are 30 sections. Also in 1914 the *AWWA Journal* came into being as a quarterly publication. Later it was issued bi-monthly; and, in 1925 became a monthly publication under the editorship of Abel Wolman of Baltimore, Md.

Standardization Becomes AWWA's Chief Objective

In the field of standardization the first step was taken at the fifth meeting of AWWA in 1885 when a special committee condemned a type of patented sheet-iron variously dipped pipe known as "Kalamein" pipe. The first affirmative standardization work is found in a set of specifications published in 1890 covering cast-iron pipe. It was, however, not until 1920 that official direction was given standarization work. Under chairmanship of Geo. W. Fuller (for whom the Fuller Awards of AWWA are named) the "Council of Standardization" was established. In 1925 an expanded Committee on Water Works Practice succeeded the Council of Standardization under leadership of Malcolm Pirnie, who was in turn succeeded in 1947 by L. R. Howson, the present chairman.

The first operating guide and reference text produced by AWWA was the then "Bible of the water works industry"—the *Manual of Water Works Practice*—1925. This text has been succeeded by individual manuals, such as the *"Manual of Water Works Accounting* —1938 and the *Manuals of Water Quality and Treatment*—first issued in 1940.

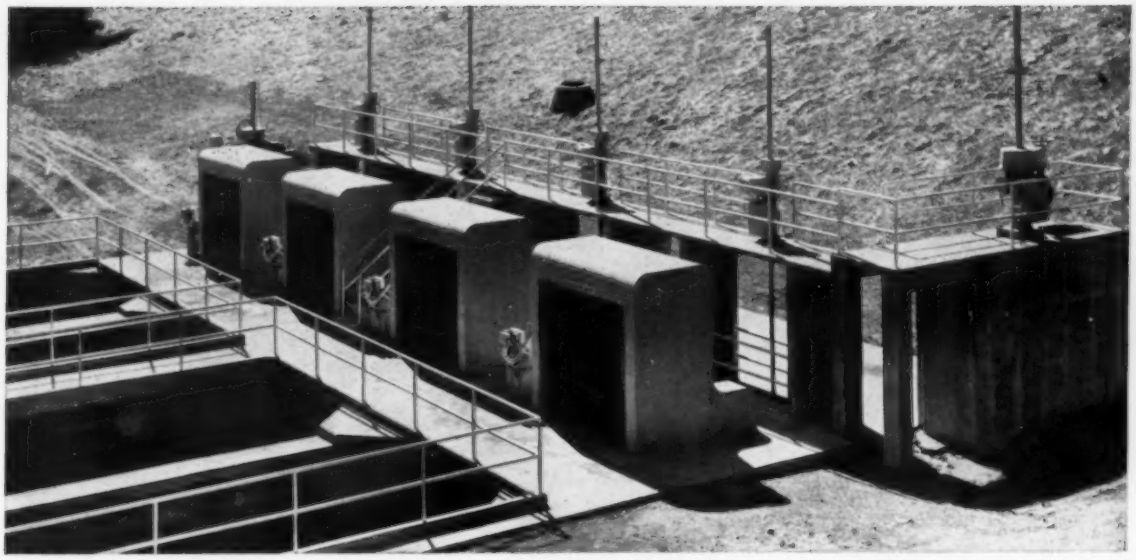
In 1948, a new and much needed committee was established in AWWA. That is the all embracing Committee on Water Works Administration, under chairmanship of past-president Wendell R. LaDue.

To see the AWWA Board of Directors down to shirtsleeve work for the three day winter sessions in New York and two sessions during the annual conventions each year; to hear of the volume of productive AWWA committee work currently in progress; to see the expansion of headquarters office activities and staff; is to realize the directive acumen and ability at getting things done that is possessed by Secretary Harry E. Jordan, who was drafted from the laboratories of the Indianapolis Water Co. in 1937 by AWWA for the job.

Credit to Whom Credit Is Due

A look at the membership growth chart from 1937 forward is in itself ample evidence of the increasing value and usefulness of AWWA to the water works profession. The section of the growth chart, reproduced on the cover, being mostly representative of what we call the "Jordanian Era", we captioned it *AWWA got a vitamin tablet . . . formula "HEJ"*. Comparing the growth curve before 1937, and since, we contend is proof enough that "formula HEJ" has proven mighty "good medicine" for AWWA. In establishing its most recent award for outstanding services AWWA's Board most appropriately named the new award—The Harry E. Jordan Achievement Award—in the spirit of "credit to whom credit is due".

L. H. Enslow



The illustration above shows the primary grit channels, four BARMINUTORS and motorized gates at the Indianapolis, Indiana sewage treatment plant. Design of plant by Moore and Heger, Consulting Engineers, Indianapolis; constructed by H. D. Tousley Company, Inc., Indianapolis, for the Indianapolis Sanitary District, Mr. Dwight O. Bender, Superintendent.

Comminution with BARMINUTORS® at Indianapolis

The BARMINUTOR screening and comminuting machine provides continuous screening and comminution of coarse material in sewage, insuring continuous raw sewage flow into the sewage treatment plant without excessive increase of water level.

Over 4000 COMMINUTOR screening and cutting machines installed since their development by the Chicago Pump Company 21 years ago stand behind the BARMINUTOR screening and comminuting machine. Thorough testing has also proved its dependability.

Write Department F for descriptive literature and engineering data.

NO SCREENING HANDLING PROBLEMS—SIMPLE LOW COST MAINTENANCE

The BARMINUTOR screening and comminuting machine eliminates raking, burial, incineration and grinding. Operation is clean and continuous, solids never leave the influent channel. Manual attention is unnecessary except for periodic lubrication, inspection and cutter sharpening. Design of cutting parts permits low cost replacement. Power requirements are lower than for mechanically raked screens and grinders. Since all cutting is done above the grit line, wear is greatly reduced.

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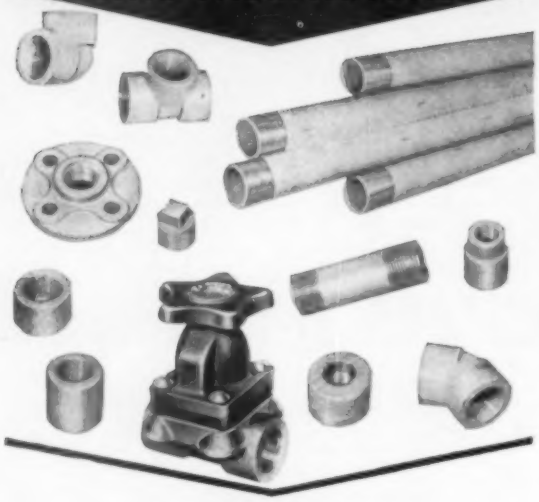

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A rigid unplasticized polyvinyl chloride, Van-Cor is fabricated into such products as: Ducts, Hoods, Chemical Tanks, Tank Liners, Plating Racks, Fume Stacks and Piping.

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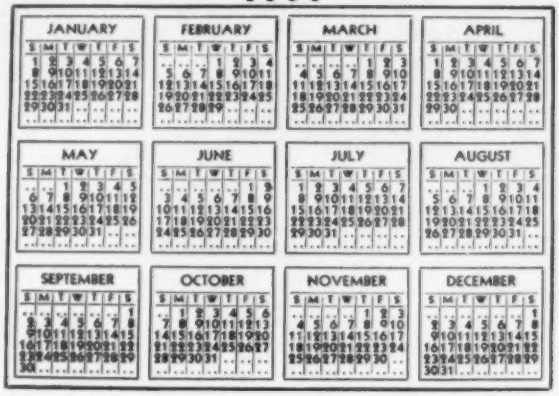

May 6-11—St. Louis, Mo. (*Diamond Jubilee Conference*)
AMERICAN WATER WORKS ASSN., Secy., Harry E. Jordan, 2 Park Ave., New York, N. Y.

May 10-11—Washington, D. C. (*Willard Hotel*)
MARYLAND-DELAWARE WATER & SEWAGE ASSN., W. M. Bingley, Secy.-Treas., 2411 N. Charles St., Baltimore 18, Md.

May 14-16—St. Joseph, Michigan (*Whitcomb Hotel*)
MICHIGAN SEWAGE & INDUSTRIAL WASTES ASSN., Donald M. Pierce, Secy.-Treas., Dept of Health, Administration Bldg., Lansing 4, Mich.

May 15-17—Lafayette, Indiana (*Purdue Memorial Union*)
PURDUE 11TH INDUSTRIAL WASTE CONFERENCE, Chairman, Don E. Bloodgood, C. E. Bldg., Purdue University, Lafayette, Indiana.

May 17-19—New York, New York (*Statler Hotel*)
THE NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, George Baer, Chairman, N. Y. State Society of Professional Engineers, Inc., 1941 Grand Central Terminal, New York 17, N. Y.

May 28-29—Buffalo, New York (*Hotel Statler*)
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSN., R. C. Sweeney, Exec. Secy., State Dept. of Health, 21 North Broadway, White Plains, N. Y.

June 4-6—Auburn, Alabama (*Ala. Polytechnic Institute*)
ALABAMA WATER & SEWAGE ASSN., W. L. Samuel, Secy., Byrd L. Moore & Co., Box 143, Fairhope, Ala.

June 4-8—Knoxville, Tenn. (*University of Tennessee*)
AMERICAN SOCIETY CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 West 39th St., New York 18, N. Y.

June 5—New Milford, N. J. (*Hackensack Water Company*)
NEW JERSEY SECTION, A.W.W.A., Plant Inspection and Spring Outing. Secy., C. B. Tygert, Box 178, Newark, N. J.

(*Continued on page* 108A)

In Bay Village, Ohio—Cuyahoga County Engineers combat corrosion in a BIG WAY...

WROUGHT IRON used for 48-inch Sewage Line

There was no question about the corrosion factors involved in the sewage line planned to serve Bay Village, Ohio. Compounding the problem was the almost inaccessible location that would make repair and maintenance difficult and expensive. And added to these considerations was the need for a material with sufficient structural strength to permit a 60-foot span between two trusses on either side of the valley the line had to cross. Cuyahoga County Sanitary Engineers, under the direction of Mr. John Puzenski, answered all these requirements with wrought iron. More than 37 tons of ½-inch wrought iron plate was fabricated into 48-inch diameter pipe and installed in approximately 270 feet of the sewage system.

Morgan Steel Products, Inc., Cleveland, Ohio, handled the fabrication. Installation work was done by The Utilities Construction Company, Cleveland, Ohio.

Our bulletin, *Wrought Iron for Sewage Treatment and Disposal Installations*, gives complete details on wrought iron's ability to last longer, at lower cost per year. Write for your copy.

"Operation Pipe Lift"—48-inch diameter section of wrought iron pipe being readied for shipment from Morgan Steel Products, Inc., fabricators.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston. San Francisco. International Division: New York, N. Y. *Available throughout the world.*

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June 7—Storrs, Connecticut (*University of Conn.*)
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSN., Henry F. Munroe, Secy.-Treas., 75 Paine Ave., Cranston 10, R. I.

June 13—Boothbay Harbor, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

June 13-15—Cleveland, Ohio (*Carter Hotel*)
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE (*30th Annual Meeting*) Ward E. Conrad, Secy.-Treas., 301 Ohio Depts. Building, Columbus 15, Ohio.

June 17-22—Atlantic City, N. J. (*Chalfonte Haddon Hall*) .... AMER. COS. FOR TESTING MATERIALS, Asst. Secy., Fred F. Van Atta, 1916 Race St., Philadelphia, Pa.

June 18-22—Meriden, N. H. (*Kimball Union Academy*)
GORDON RESEARCH CONFERENCE ON STREAM SANITATION, W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, R. I.

June 20-22—Green Bay, Wisconsin (*Northland Hotel*)
CENTRAL STATES SEWAGE & INDUSTRIAL WASTES ASSN., Geo. F. Bernauer, Secy.-Treas., 713 Chapman Street, Madison, Wis.

Aug. 8—Kennebunk, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

Aug. 27-29—University Park, Pa. (*Pennsylvania State Univ.*)
PENNA. WATER WORKS OPERATOR'S ASSN., Secy., R. Rupert Kountz, Dept. San. Eng., Penna. State Univ., University Park, Pa.

August 29-31—University Park, Pa. (*Pennsylvania State Univ.*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, 916 Diamond, Meadville, Pa.

Sept. 5-7—Clear Lake, Iowa (*P. M. Park*)
IOWA SEWAGE & INDUSTRIAL WASTES ASSN., L. F. Skorczeski, Secy.-Treas. 207 South 15th Avenue, Marshalltown, Iowa.

Sept. 9-12—Pittsburgh, Pa. (*Wm. Penn Hotel*)
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, F. J. Van Antwerpen, 25 West 45th St., New York 36, N. Y.

Sept. 12-14—Bolton Landing, Lake George, N. Y. (*Sagamore Inn*)
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Sept. 12-14—Flint, Michigan (*Durant Hotel*)
MICHIGAN SECTION, A.W.W.A., Secy., T. L. Vander Velde, Mich. Dept. of Health, Lansing 4, Mich.

Sept. 12-14—St. Paul, Minn. (*Lowry Hotel*)
NORTH CENTRAL SECTION A.W.W.A., Secy., Leonard N. Thompson, Gen. Manager, Water Dept., St. Paul 2, Minn.

Sept. 16-19—Bretton Woods, N. H. (*Mt. Washington Hotel*)
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, N.E.W.W.A., 73 Tremont St., Boston 8, Mass.

Sept. 17-19—Chattanooga, Tenn. (*Hotel Patten*)
KENTUCKY-TENN. SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell Engrs., 533 S. Limestone St., Lexington, Ky. and KENTUCKY-TENN. INDUSTRIAL WASTES & SEWAGE WORKS ASSN., S. Leary Jones, Secy.-Treas., Cordell Hull Building, Nashville, Tenn.

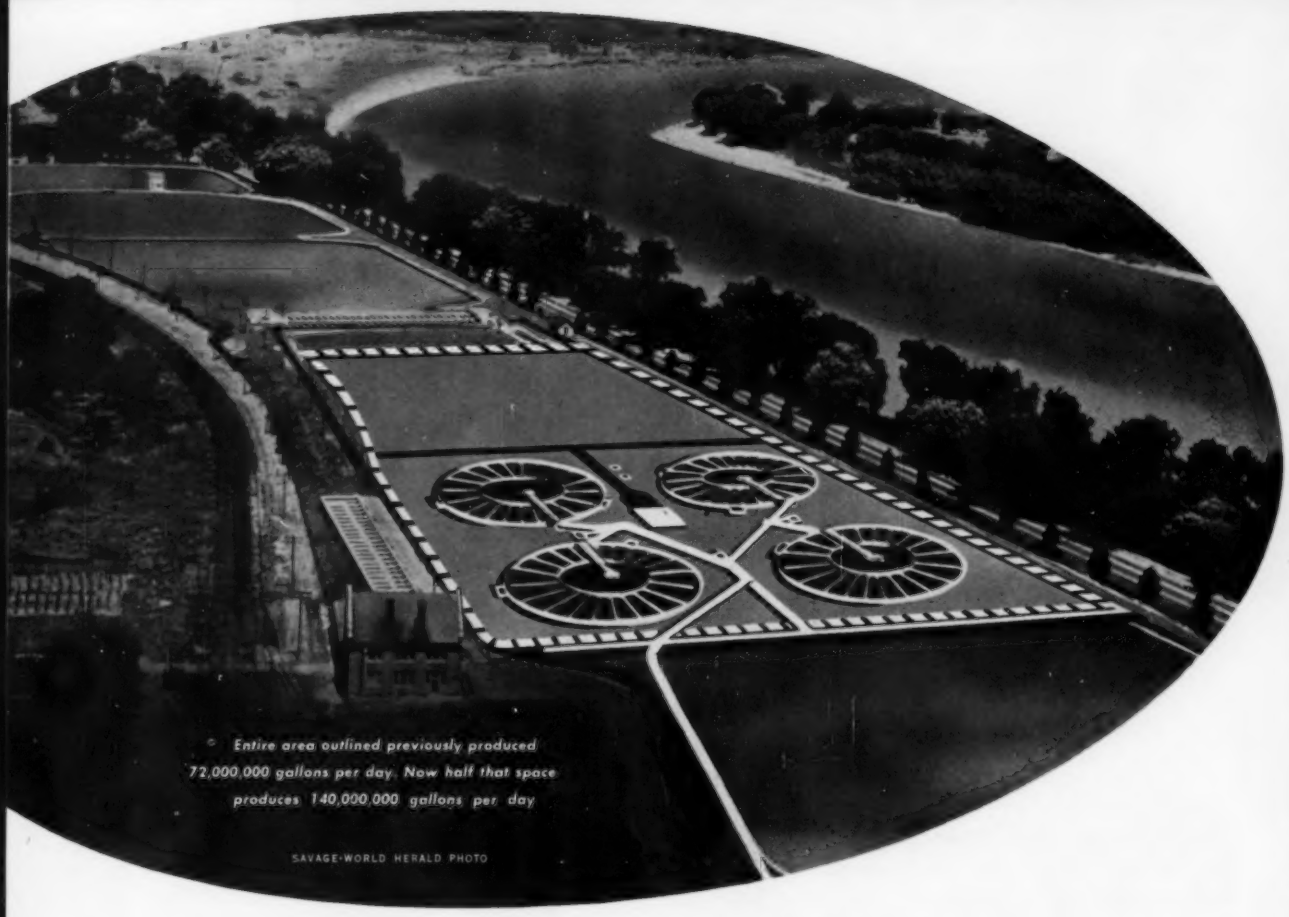
Sept. 19-21—Atlanta, Georgia (*Georgia Tech.*)
GEORGIA WATER & SEWAGE ASSN., 25th Annual Georgia Water & Sewage School, Georgia Institute of Technology, A. T. Storey, Secy.-Treas., 1210 Hemphill Ave., N. W., Atlanta, Ga.

Sept. 19-21—Toledo, Ohio (*Commodore Perry Hotel*)
OHIO SECTION, A.W.W.A., Secy., M. E. Druly, Dist. Mgr., Dayton Power & Light Co., Wilmington, Ohio.

Sept. 19-21—Aberdeen, So. Dakota (*Hotel to be announced*)
SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE Charles E. Carl, Secy.-Treas., Div. of San. Eng., State Board of Health, Pierre, S. Dak.

Sept. 23-26—Fort Worth, Texas (*Texas Hotel*)
AMERICAN PUBLIC WORKS ASSN., (Public Works Congress), Robert D. Bugher, Asst. Director, 1313 E. 60th St., Chicago 37, Ill.

(*Continued on page* 112A)



Entire area outlined previously produced 72,000,000 gallons per day. Now half that space produces 140,000,000 gallons per day

SAVAGE-WORLD HERALD PHOTO

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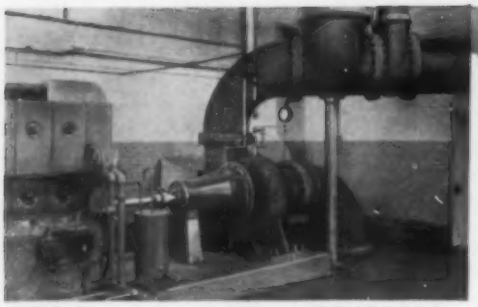


MDC Quincy (sewage): Twin 20" F-M "Angle-flow" pumps are driven by F-M diesels in this station recently converted from steam power.

MDC Charlestown (sewage): Two F-M diesels drive 36" F-M vertical pumps. The engines also drive 20 kw. F-M generators.

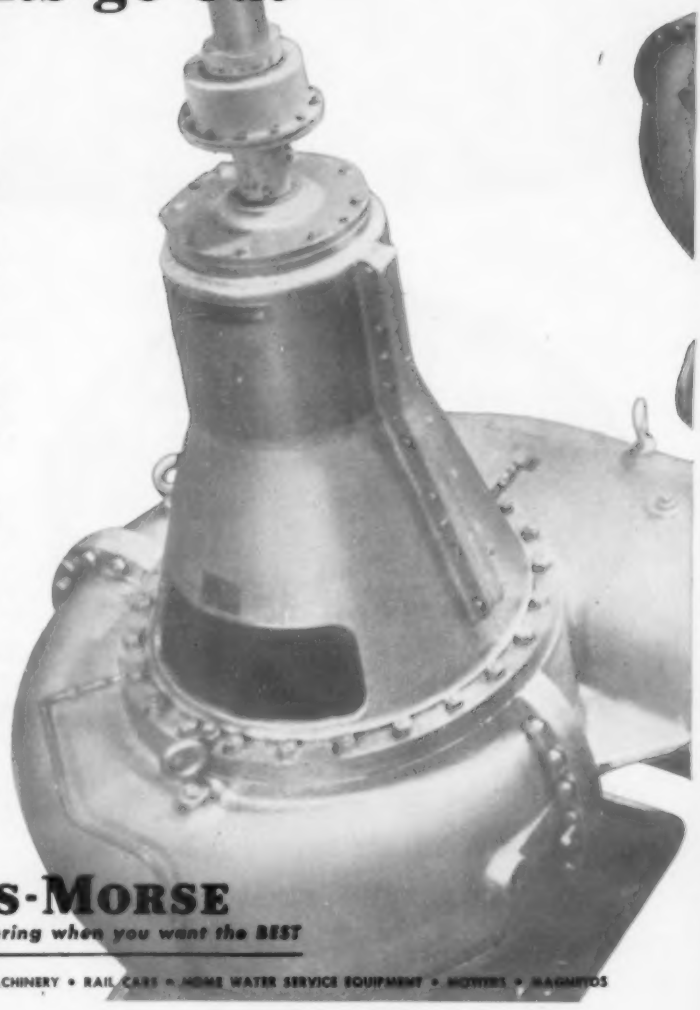
When the lights go out

...MDC keeps pumping. MDC is the Metropolitan District Commission, an organization which exists to provide coordinated municipal services, parkways and recreational facilities for Boston and many of the cities and towns which are integrated in the metropolitan area.

Many of MDC's water and sewage pumping stations are completely self-sufficient. Others, dependent for normal service on utility electric power, have stand-by power of their own—just in case the lights go out.

Fairbanks-Morse has supplied the driving as well as the driven member in many MDC installations. F-M diesels drive F-M pumps in continuous service. Other F-M pumps are driven by F-M motors. Still others, diesel powered, are standing by for the possible emergency.

Whatever your problem in municipal pumping, Fairbanks-Morse has the pump . . . and the driver . . . and the engineering to solve it. Fairbanks, Morse & Co., Chicago 5, Illinois.



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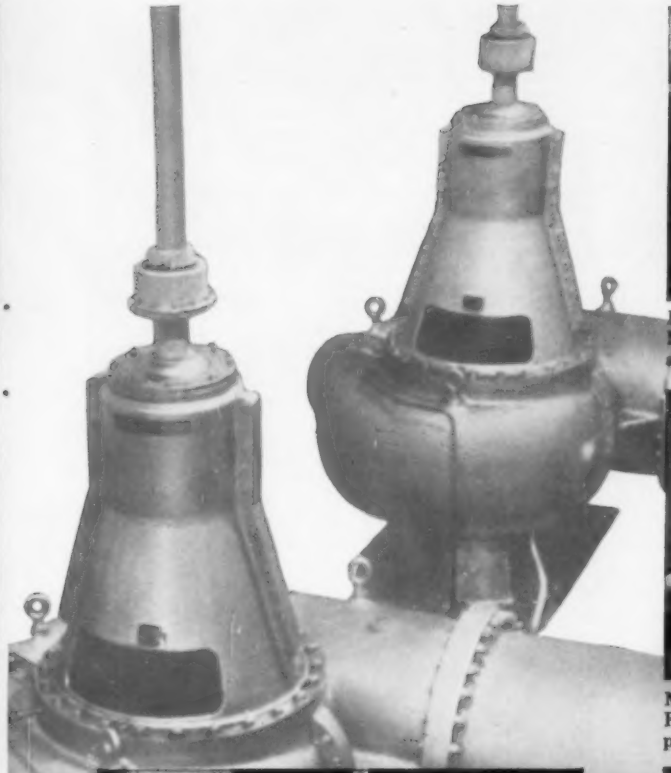
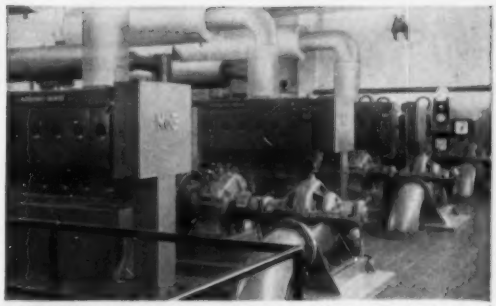
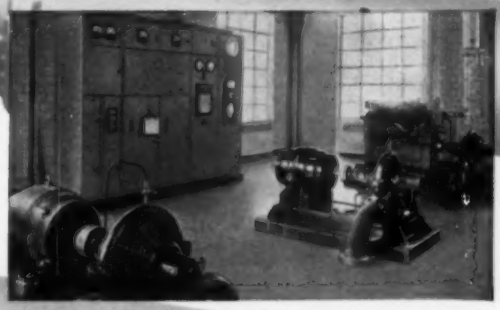
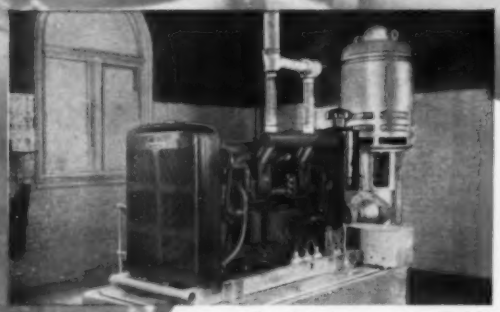




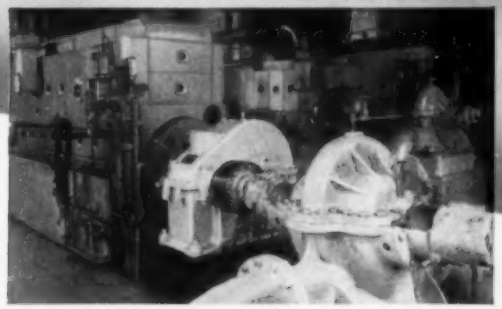
MDC Brookline (water supply): The new station on Newton Street houses three F-M centrifugal pumps and three F-M diesel engines.



MDC Waltham (water supply): F-M pumps and F-M motors fill routine demands. A third pump, powered by an F-M diesel, stands by for emergency.

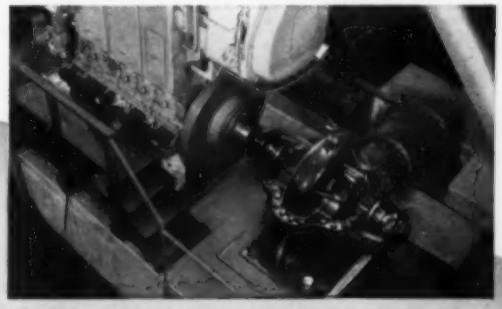


MDC Reading (sewage): In this two-pump (F-M) station, an F-M diesel can take over in the event of power failure to the 100 hp. F-M electric motor.



MDC Arlington (water supply): In a station recently converted from steam power, Fairbanks-Morse centrifugal pumps are driven by F-M diesels.

MDC Alewife Brook (sewage): In this new all-electric pumping station, two 36" and one 16" F-M "Angleflow" pumps are motor driven from the floor above.



MDC Spot Pond (water supply): A 20" F-M centrifugal (illustrated) and a 36" F-M turbine, driven by F-M diesels, are taking over from steam.

STOP
VALVE CORROSION
...at lower cost

For handling most corrosive fluids, there's an Ace hard rubber, rubber-lined or plastic valve that will stop corrosion failures without costing you a fortune. Check this partial list:

Plastic Diaphragm Valves	½" to 2"
Rubber-Lined Gate Valves	2" to 24"
Rubber-Lined Diaphragm Valves	½" to 14"
Rubber-Lined Check Valves	2" to 24"
Hard Rubber Plug Valves	¼" to 5"

— plus bibb cocks, ball check valves, float valves, etc.

For lists of chemicals that can be handled and other details write *today* to:

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ACE rubber and plastic
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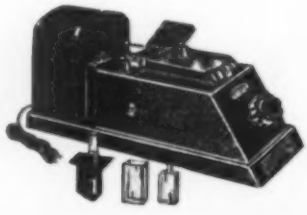
ELECTRIC PHOTOMETER

Adaptable for Use in Water Analysis



Can be used for any determination in which color turbidity can be developed in proportion to substance to be determined.

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Sept. 26-28—LaCrosse, Wisconsin (*Stoddard Hotel*)
WISCONSIN SECTION, A.W.W.A., Leon A. Smith, Supt. Water and Sewage, City Hall, Madison 3, Wisconsin.

Sept. 30-Oct. 1, 2—Jefferson City, Missouri (*Hotel Governor*)
MISSOURI SECTION, A.W.W.A., and
MISSOURI WATER & SEWAGE CONFERENCE, Warren A. Kramer, Secy.-Treas., Division of Health, Jefferson City, Missouri.

Oct. 3-5—Mandan, No. Dakota (*Lewis & Clark Hotel*)
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE, Jerome H. Syore, Secy.-Treas., % State Dept. of Health, Bismarck, N. Dakota.

Oct. 4-6—Boise, Idaho (*Hotel Boise*)
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTES ASSN., W. W. Saxton, Secy.-Treas., 408 Old Capitol Bldg., Olympia.

Oct. 8-11—Los Angeles, Calif. (*Hotel Statler*)
FEDERATION OF SEWAGE AND INDUSTRIAL WASTES ASSNS., Ralph E. Fuhrman, Exec. Secy., 4435 Wisconsin Ave., N.W., Washington 16, D. C.

Oct. 10—Caribou, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

Oct. 14-17—Little Rock, Arkansas (*Marion Hotel*)
SOUTHWEST SECTION, A.W.W.A., Secy., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 15-16—St. John, New Brunswick (*Admiral Beatty Hotel*)
MARITIME BRANCH, CANADIAN SECTION, A.W.W.A., J. D. Kline, Secy.-Treas., Public Service Comm., P.O. Box 608, Halifax, N. S.

Oct. 15-19—Pittsburgh, Pa. (*Wm. Penn Hotel*)
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

Oct. 18-20—Atlantic City, N. J. (*Hotel Madison*)
NEW JERSEY SECTION, A.W.W.A., Secy., C. B. Tygert, Box 178, Newark 1, N. J.

Oct. 21-24—Mobile, Alabama (*Battlehouse Hotel*)
ALABAMA-MISSISSIPPI SECTION, A.W.W.A., Secy., Charles W. White, State Dept. Public Health, 537 Dexter Ave., Montgomery, Ala.

Oct. 22-26—San Diego, Calif. (*U. S. Grant Hotel*)
CALIFORNIA SECTION, A.W.W.A., Secy., H. J. Ongerth, Engr., State Dept. Health, 2180 Milvia St., Berkeley, Calif.

Oct. 24-26—Des Moines, Iowa (*Hotel Fort Des Moines*)
IOWA SECTION, A.W.W.A., Secy., J. J. Hail, Sup. of Water, City Hall, Dubuque, Iowa.

Oct. 24-26—Baltimore, Maryland (*Sheraton Belvedere*)
CHESAPEAKE SECTION, A.W.W.A., Secy., Carl J. Lauter, 6955 33rd Street, Washington 15, D. C.

Oct. 29-31—Windsor, Ontario (*Prince Edward Hotel*)
THE CANADIAN INSTITUTE ON SEWAGE & SANITATION, A. E. Berry, Secy.-Treas., Ontario Dept. of Health, Parliament Bldg., Toronto, Canada.

Oct. 31-Nov. 1-2—Bluefield, W. V. (*West Virginia Hotel*)
WEST VIRGINIA SECTION, A.W.W.A., Secy., Hugh W. Hetzer, Engr., W. Va., Water Service Co., Charleston, W. Va., and
WEST VIRGINIA & INDUSTRIAL WASTES ASSN., G. O. Fortney, Secy.-Treas., State Health Dept., Charleston 5, W. Va.

Nov. 1-2—Omaha, Nebraska (*Castle Hotel*)
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN., V. J. Lechtenberg, Secy.-Treas., 614 Standard Oil Bldg., Omaha, Neb.

Nov. 7-9—Old Point Comfort, Virginia (*Chamberlin Hotel*)
VIRGINIA SECTION, A.W.W.A., Secy., J. P. Kavanagh, 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 11-14—Daytona Beach, Fla. (*Daytona Plaza Hotel*)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSN., M. E. Dawkins, Secy.-Treas., % Reynolds, Smith & Hills, P.O. Box 4817, Jacksonville 1, Fla.

Nov. 12-14—Charlotte, N. C. (*Hotel Charlotte*)
NORTH CAROLINA SECTION, A.W.W.A., and
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSN., W. E. Long, Jr., Secy.-Treas., Box 2091, Raleigh, N. C.

Nov. 12-16—Atlantic City, N. J. (*Convention Hall*)
AMERICAN PUBLIC HEALTH ASSN., Secy., Dr. Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Nov. 26-28—Colorado Springs, Colo. (*Broadmoor Hotel*)
ROCKY MOUNTAIN SECTION, A.W.W.A., Jack W. Davis, Secy., Johns-Manville Sales Inc., Denver, Colorado.

Dec. 12—Pittsfield, Maine
MAINE WATER UTILITIES ASSOCIATION, Gerard F. Laurin, Secy.-Treas., 89 Western Avenue, Augusta, Maine.

"Old Faithful" — This Le Roi engine provided 17 years of dependable service without a forced shutdown for the City of Battle Creek, Michigan. Shown below is the modern H540/V-8, with John Larson. Mr. Larson has had 30 years' experience operating stationary engines, and really knows a good engine when he sees one.

122,105.6 hours logged with only four overhauls

...dependable performance like this proves the value of Le Roi engines

In 1937, the City of Battle Creek installed its first Le Roi engine. Seventeen years later, when it was time to modernize, this engine had piled up the amazing total of hours shown above.

This is just one more example of Le Roi dependability. It is also proof of the excellent maintenance work performed by John Larson and his staff.

In 1954, "Old Faithful" was replaced by Le Roi's H540, a modern short-stroke V-8. The H540 normally operates at 1500 rpm, but, because of its short stroke V-8 design, piston speed is no greater than that of longer stroke, slower speed engines.

Moreover, the H540 provides new flexibility. This flexibility really paid off during flood conditions when the electric pumps were shorted out. The H540 ran up to 2100 rpm and, by so doing, carried the entire plant load for several days.

Performance during this emergency clearly indicated the advantages of the H540's short-stroke V-8 design. It proved that you get more horsepower per dollar and more horsepower per space. Other plus factors are easier servicing and easier installation.

Whether it's for continuous or standby service, or for pumps, blowers, or generators, it pays to use Le Roi engines. Le Roi power is dependable, low-cost power — power that can help ease the tax load in your community. You can get it in sizes ranging to 645 hp., or in custom generator sets from 50 to 350 KW. Write us for detailed information.

E-193

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS · TRACTAIR · STATIONARY AIR COMPRESSORS · AIR TOOLS · ENGINES

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

New Equipment

Handy Pipe Cleaning Unit

501

The Miller Sewer Rod Co., Chicago, Illinois, has developed a new unit that is designed for cleaning out the most stubborn drain and sewer stoppages in a matter of minutes.

Consisting of a housing, cable and speed handle, the new Miller Rod House will clean out clogged toilets, wash basins, urinals, and floor drains up to 100 ft in length. Easy to operate, the rod is simply pushed into the line until resistance is met, then the handle is slid to within a few inches of the opening, the set screw is tightened, the speed handle is turned and the Miller Rod is whirled down the pipe cleaning out rags, scale, sand, grease, and other obstructions.

Hardinge CLARIFIERS for rectangular tanks

Three Hardinge primary clarifier units in 22′ x 68′ x 17′ tanks at the municipal sewage disposal plant in York, Pennsylvania. Other Hardinge equipment in this plant—final clarifiers, sludge thickener and digesters. (Albright & Friel, Consultants)

Hardinge has installed more than 70 rectangular clarifier units for municipal sewage treatment, oil refinery wastes and miscellaneous industrial liquid wastes—processing in excess of 300 million gallons of liquid daily.

Complete specifications for all types and sizes upon request. Bulletin 35-D- 15

HARDINGE COMPANY, INCORPORATED

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New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

Electronic Device Controls Conductivity of Solutions

502

The Fielden Instrument Div. of Robertshaw-Fulton Controls Co., Philadelphia, Pa., has developed a new electronic instrument for controlling the conductivity of solutions.

The new device, which is an adaptation of the Fielden Series 97 temperature controller, fills the need in industry for a low cost solution conductivity controller where recording is not required. The instrument, it was stated, will find wide application in the water treatment, chemical, nuclear energy, power and metal processing industries.

Designed for simplified use and operation, the controller is equipped with two zone action for both alarm or control. A single set-point knob on the front provides control within the range of the instrument calibration. It is available in two standard ranges of conductivity: 0 to 30 micromhos/cm3, or 20 to 200 micromhos/cm3, for use with conductivity cells having a constant of one. The scale calibration is non-linear and provides maximum readability at high specific conductivities.

New Pipe Joint Cement

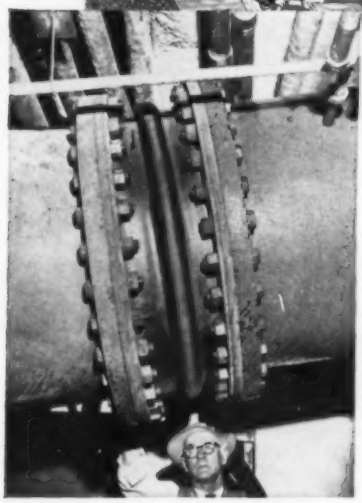
503

J. A. Sexauer Manufacturing Co., Inc., New York, N. Y., has developed a new, improved pipe joint cement that provides lubrication as well as a permanent seal against leaks.

Called "Stay-Tite" pipe joint cement, the manufacturer claims it effects economies 3 ways. First, it does not harden in the can, thereby eliminating waste. Second it retains its sealing qualities indefinitely and eliminates costly repairs. Third, this pipe joint

(*Continued on page* 116A)

KEEPING A CITY'S FEET DRY...



Note great size of this U. S. Expansion Joint installed on a generator in the New Orleans S&WB plant at Eagle and Spruce Streets

for over 26 years U. S. Rubber Expansion Joints have been doing just that!

New Orleans is a city nestled in a saucer. Surrounded on all sides by water, many of its areas are below sea level. Add to this, one of the heaviest rainfalls in the country (as much as 15 inches in 17 hours) and you can see that this glamour city could easily be flooded.

But the New Orleans S&WB* keeps the city's feet dry by means of a pumping system that carries off the rain. Turbo-generators supply the power not only to operate this drainage pumping system but also the separate sewage pumping and the water supply systems.

26 years ago, one of these turbo-generators *(in use 98% of the time)* was equipped with 5 United States Rubber Company Expansion Joints. Why? To allow for contraction and expansion in pipe lines, and to counteract vibration. Says the Chief engineer of the S&WB: *"The U. S. Joints have never failed in all that time.* If any of them ever had, the turbine would be out of use."

U. S. Expansion Joints are widely used in the pipe lines of utility generating plants, municipal water supply systems, office and apartment buildings, ships —wherever pipe lines have to be protected against vibration, contraction and expansion. These joints soon pay for themselves by eliminating expensive maintenance and replacement in pipe lines. They eliminate noise. Once installed, you can count on years of trouble-free service. Obtainable at any of the 27 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

cement remains in a plastic state after being applied; fittings can be easily removed at any time without breakage.

The pipe joint cement is said to be equally effective on high or low pressure piping use for practically any purpose including hot or cold water, steam, air, oil, gasoline and gas—including butane or propane.

Portable Submersible Sump And Waste Pump

504

Pleuger Submersible Pumps, Inc., Lancaster, Pa., has developed a submersible sump and waste pump that is said to be the only submersible that can pump down to a water level of 4 in. because its water intake is located at the bottom of the unit.

The pump is powered with a water-filled and water-lubricated motor. Location of the motor above the pump provides automatic protection against dirt and sand infiltration. Water is drawn directly into the first stage of the pump, by-passing the water lubricated motor, and is delivered through the 2½ in. hose connection on the discharge outlet. It is 8 in. in diameter and weighs from 130 to 175 lb, depending on the model. The pump is offered with 5, 10, and 15 hp with capacities up to 300 gpm, for heads to 140 ft.

Van-Cor Plastic Pipe Approved By National Sanitation Foundation

505

Colonial Plastics Mfg. Co., Cleveland, Ohio, has announced that Van-Cor plastic pipe has been declared safe for use in systems transporting drinking water by the National Sanitation Foundation.

Van-Cor is made of unplasticized polyvinyl chloride, which combines toughness, good tensile and flexural strength and good thermal properties. It weighs only one-half as much as aluminum. Pipe diameters range from ½ in. through 12 in.

Hydraulic Pipe Pusher

506

Mercury Hydraulics, Inc., Denver, Colorado, has developed a completely powered 21 in. stroke, one man operated "Speed-Thru" pipe pusher.

Two models are currently available to handle ¾ to 4 in. pipe. Mercury Hydraulics claims that its "Speed-Thru" performance records of 75 ft in 18 to 20 min on 2 in. pipe through formations of heavy compaction, and distance pushes up to 186 ft, are faster and more economical than any other method.

Simple operation of two controls pushes pipe in continuous 21 in. thrusts. Hydraulic power is furnished by gas engine, DC truck power or AC electric power units as desired. Two 25 ft hydraulic pressure and return hoses, equipped with quick couplers, expedite setting.

By reversing the forward pushing principle, "Speed-Thru" will pull pipe as rapidly as it pushes, facilitating the installation of copper or plastic pipe as well as steel. It is not necessary to turn the machine or adjust power or speed for pulling operations.

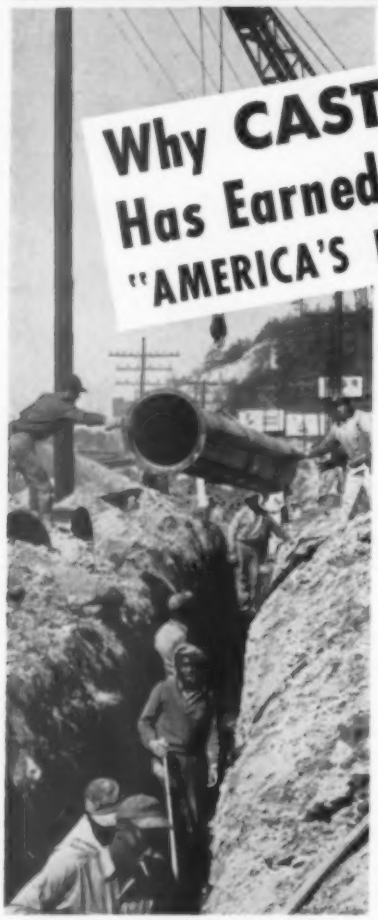
Bacterial Formula Reduces Sludge Withdrawals

507

The FX-Lab Company, Newark, N. J., has announced that a new bacterial discovery, Formula FX-21, reduces sludge withdrawals in municipal sewage treatment plants by means of recently developed reproductive, spore-bearing organisms.

According to the company, an eleven

(*Continued on page* 118*A*)



Why CAST IRON PIPE Has Earned its Reputation "AMERICA'S NO. 1 TAX SAVER"

Longest Life

Actual records of more than 100 large cities which have water systems 100 years and older and still in service, prove that Cast Iron pipe is lowest in cost over the years.

Lowest Maintenance Cost

because of its effective resistance to corrosion and its wide margins of safety in strength to withstand impact, beam and crushing stresses.

Saves Money On Street Openings

because long-lived pipe obviously causes less street-opening for replacement and repairs.

High Salvage Value

When water mains must be abandoned, re-routed or replaced by larger sizes, Cast Iron Pipe may be re-used or salvaged, regardless of its age.

***Specify* CAST IRON PIPE**

and effect these savings for your community.

Our Company does not manufacture pipe but has long supplied the nation's leading pipe manufacturers with quality iron from which pipe is made.

WOODWARD IRON COMPANY
WOODWARD, ALABAMA

ANHYDROUS FERRIC CHLORIDE SIMPLIFIES COAGULATION

Concentrated, economical Ferric Chloride by Pennsalt is achieving wider and wider use in large and small sewage-disposal systems.

- It speeds vacuum filtration, eases filter loads, increases filter capacity.
- Its superior flocculating action produces drier, easier-to-handle cakes.

WRITE FOR TECHNICAL BULLETIN on Pennsalt Anhydrous Ferric Chloride. Industrial Chemicals Division, Pennsylvania Salt Manufacturing Company, Three Penn Center Plaza, Philadelphia 2, Pa.

OTHER CHEMICALS SUPPLIED BY PENNSALT FOR WATER AND SEWAGE TREATMENT INCLUDE
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Cincinnati 2, Ohio—Main 1-3168
Cleveland 2, Ohio—Main 1-6205
Decatur, Ga.—Evergreen 9690
Detroit 26, Mich.—Woodward 1-8051
Paterson 1, N.J.—Lambert 5-3500
Philadelphia 2, Pa.—Locust 4-3852
Pittsburgh 19, Pa.—Atlantic 1-5233
St. Louis 1, Mo.—Parkview 5-8394
Tacoma 2, Wash.—Market 9101

Pennsalt Chemicals

month test recently completed at a treatment plant in New Jersey showed a reduction in sludge withdrawals of more than 80 per cent, thereby in effect, increasing the capacity of the digestion tank facilities approximately five times.

When both digesters in the municipal treatment plant were treated with FX-21 bacteriological cultures during the second period of 5½ months, and the results compared with those of the previous year, the total amount of sludge withdrawn was 10,000 cu ft, compared with 65,000 cu ft during the same period of the previous year.

Cleaning Fluid For Pump Bowls And Impellers

508

Fine Organics, Inc., New York, N. Y., has developed a cleaning fluid called "F.O. 190" that has been found to be an excellent cleaning agent for pump bowls and impellers.

The cleaning fluid is an acidic product comprising a properly inhibited acid, coupling agents and surface-active agents, designed to remove light rust and corrosion quickly and easily. F.O. 190 is designed to remove soil and corrosion from brass, aluminum, copper, tin, stainless steel and alloys of aluminum, copper and ferrous metals where subsequent surface coating is not planned.

The company suggests that the parts be immersed in a hot or cold solution made up of 1 part F.O. 190 to 3 parts of water. If a cold dip is used, allow the parts to soak for 5-15 min until the rust or corrosion is loosened, remove, rinse in clear water and dry. A hot water rinse is recommended. For hot dip, heat the solution to 140°F, immerse the work for 1-2 min, remove, rinse and dry thoroughly.

FROM THE FILES OF DR. CENTRILINE...

CASE #6042

PATIENT: 36 miles of twin 20" Cast Iron supply lines, Portsmouth, Virginia.

SYMPTOMS: Insufficient water in Portsmouth.

DIAGNOSIS: Low pipeline capacity caused by flow restricting tuberculation.

TREATMENT: The twin 20" mains were cleaned and cement lined in place without interruption of water supply service to Portsmouth. The Centriline Process of centrifugally applying cement mortar was used.

RESULTS: Each pipeline is now capable of permanently carrying twice as much water as prior to cleaning and lining.

Examine your own capacity, corrosion and leakage problems to determine the value of the Centriline treatment to you. Cleaning and cement lining in place has been the successful remedy for almost 1,000 miles of water supply pipelines.

CENTRILINE CORPORATION

A subsidiary of the Raymond Concrete Pile Company

140 CEDAR STREET, NEW YORK 6, N.Y.
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Branch Offices in Principal Cities of the United States, Canada, and Latin America.

Immersed Float Vacuum Transmitter

509

Fischer & Porter Co., Hatboro, Pa., has developed an immersed float vacuum transmitter, primarily designed for use with F&P automatic proportioning chlorinators.

The transmitter, a force balance type with no moving parts, gives a vacuum signal proportional to the main line water flow. The signal governs the amount of chlorine introduced into the system by the chlorinator. The equipment is suitable for use in Parshall flumes, Kennison nozzles and weirs. It is unaffected by chlorine, sewage gases or weather and virtually no maintenance is required.

Visible Wedge Valves

510

Hamer Valves, Inc., Long Beach, Calif., has available three new styles of their visible wedge valve, a Tee, Horizontal Ell and Vertical Ell.

All the valves have the same center-to-face dimensions as standard tee and elbow pipe fittings. These three new body styles, along with a straightway model provide all of the configurations necessary for modern piping and piping manifold requirements. All four visible wedge valves incorporate the impenetrable sealing action of the line blind with the simplicity of operation found in a gate valve.

One glance at the valve is all that is required to determine whether the line is full open or full closed. A precision metal-to-metal fit on the wedge and seats, augmented by dependable seal rings provides a foolproof line shut-off.

Space Deodorizer

511

Aireactor Corp., New York, N. Y., has developed Aireactor, a space deodorizer used by industries and mu-

(*Continued on page 120A*)

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Information — Literature

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for dependable pipe line equipment

Like hundreds of Pollard customers, you'll find it mighty pleasant and convenient to order pipe line equipment from Pollard.

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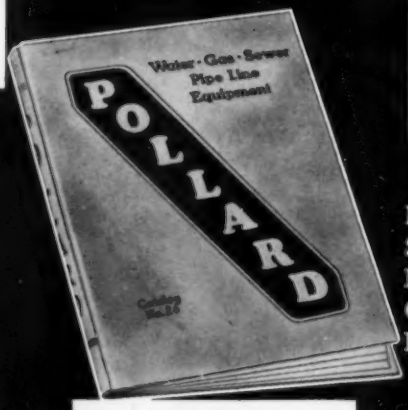
JOINT RUNNERS

DIAPHRAGM PUMPS



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CALKING TOOLS

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PIPE LINE EQUIPMENT

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PIPE LINE EQUIPMENT

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Branch Offices: 1064 Peoples Gas Building, Chicago, Illinois
333 Candler Building, Atlanta, Georgia

nicipalities to control outdoor odors.

This new space deodorant is a clear, non-flammable solution which, when vaporized, destroys odors but leaves no odor of its own. According to the manufacturer, it is created from rare, non-toxic elements in plant life, and obtains its results like masses of green foliage do in nature.

Special patented deodorizing equipment is provided by the Aireactor Corp., and the DeVilbiss Company who have designed and manufactured special equipment which automatically regulates and diffuses Aireactor vapors.

Dual Purpose Repair Clamp

512

Smith-Blair, Inc., South San Francisco, Calif., has developed an improved dual purpose repair clamp for water, gas or oil pipelines. Its specific applications are for quick, permanent repair of cracked or broken pipe and to connect two lengths of cast-iron, steel or asbestos-cement pipe in the trench.

The new Full Circle Clamp coupling embodies ball and socket pivoting ductile iron lugs and free floating bolts. These features give increased holding power and make the clamp easy to install on the pipe without service shutoff. The matching halves of the Smith-Blair Full Circle Clamp couplings are preassembled with the gridded gasket and its armored insert factory bonded in accurate alignment. By simply opening one side of the clamp it can be dropped over the pipe. There are no loose parts. The metal bands are made of cold rolled copper or stainless steel, and are furnished with silicon bronze or stainless steel bolts for corrosive conditions.

Adhesives For Clay Pipe

513

Furane Plastics, Incorporated, Los Angeles, Calif., has developed some unique epoxy pastes for bonding clay pipes. These pastes are available in cream or aluminum color and in various consistencies. They are chemically resistant to most acids, alkalies, sewage effluents, and some solvents and set hard at room temperature.

Giant Ditcher Excavates 600 Cubic Yards Per Hour

514

Gar Wood Industries' Findlay Division, Wayne, Michigan, has announced that the world's largest ditching machine, the Gar Wood-Buckeye 330, has just successfully completed its first field trials.

According to W. I. Crabiel, chief engineer at Gar Wood's Findlay division, "The 330, that excavates 600 cu yd of dirt per hour and cuts a trench 11 ft 3 in. deep, and 5 ft 4 in. wide, was designed to meet the need for a heavy duty pipeline ditcher that could also be adapted for deep sewer work. Recently, both 30 and 36 in. pipelines have been installed in several parts of the country, but until the introduction of the 330, there was no specialized ditching equipment capable of excavating a trench of the required dimensions." Engineers conservatively rate the digging capacity of the giant ditcher at 600 cu yd per hr which means that matched against a ¾ yd back hoe, normally used for trenches of this size, the 330 is eight times more efficient.

(*Continued on page* 122*A*)

ongratulations

A.W.W.A.

it's NATIONAL'S *birthday, too!*

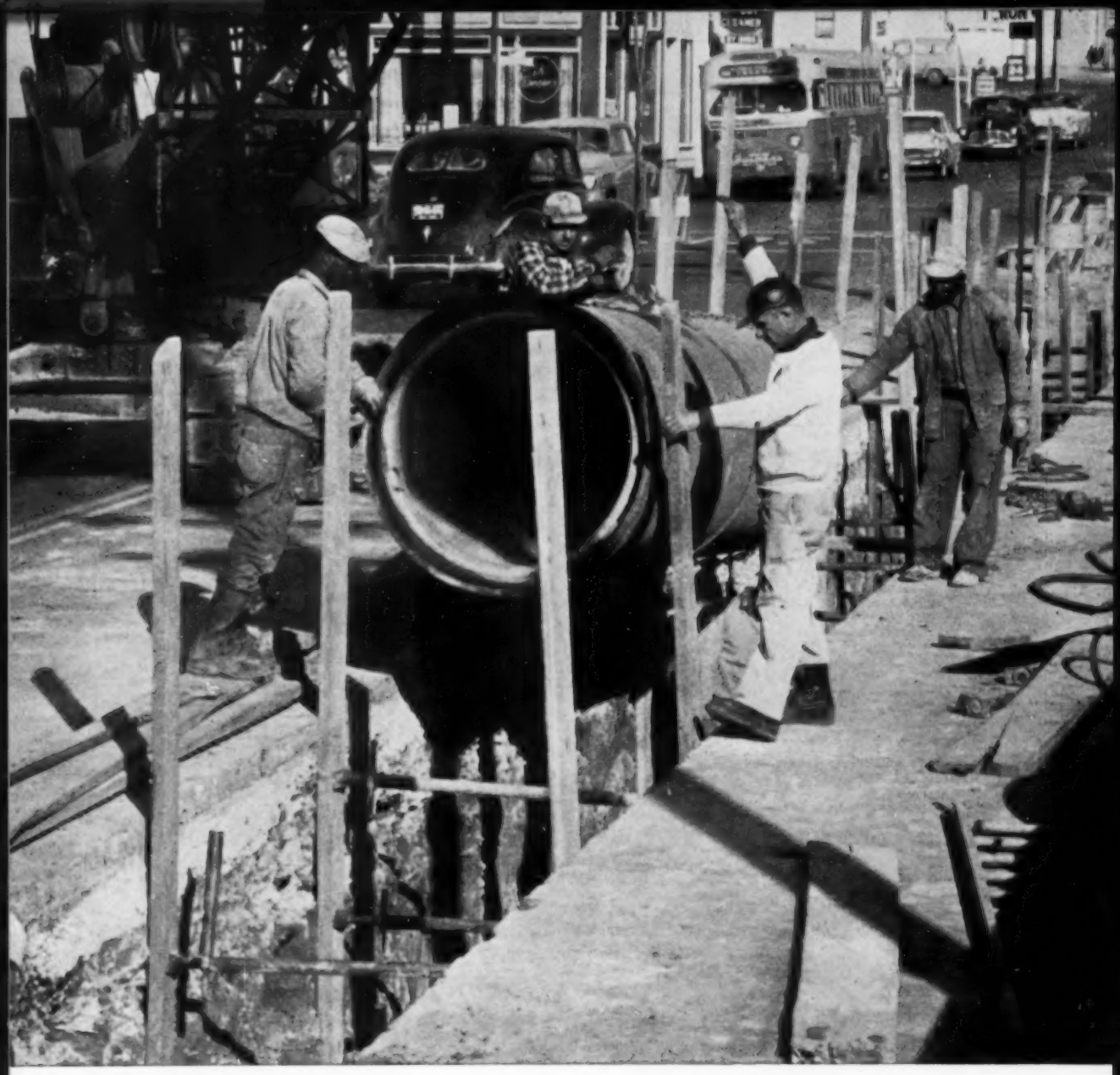
We are proud to salute the American Water Works Association on their 75th year of progress and achievement in the Water Works field! And, we're proud for another reason—it's National's 50th Anniversary! For us, it means a half-century of progress increasing efficiency, carrying capacity and pressure of water mains *all over the world!*

Write us today for facts and information that shows how National's 50 years of experience cleaning water mains can restore your system to at least 95% of its original rated capacity.

You are cordially invited to visit our booths numbers 1 and 2 at the National Convention of the American Water Works Association, to be held in St. Louis, Missouri.

50TH NATIONAL ANNIVERSARY

WATER MAIN CLEANING CO.
50 Church St., New York 7, N. Y.



Price

Concrete Pipe for Cincinnati's Montgomery Road

Montgomery Road is a main artery that feeds into Cincinnati from the northeast. It carries a heavy load of traffic, so when an extension of a 36-inch water supply line was planned, ease of installation was an important consideration.

Prestressed concrete cylinder pipe turned out to be a happy choice. The job went smoothly for the contractor, A. F. Jelen & Son Co., and the highway was kept open to traffic even through congested districts like the one in the picture. Basic reason was the steel-and-rubber joint which is made quickly and easily . . . and incidentally makes a bottletight, yet flexible joint that is designed to take heavy traffic loads.

The line is 11,000 feet long and includes both 30 and 36-inch pipe. Along with 620 standard 16-foot lengths, the contractor installed 16 bends, 2 wyes, 3 reducers, 3 tees, 2 closure assemblies, one cross, and a number of short lengths and bevel adapters.

For information on any type of concrete pressure pipe for either water supply or pressure sewer lines, write Price Brothers Company, Dayton, Ohio.

• **If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.**

Verti-Line Package Pump
515

Layne & Bowler Pump Company, Los Angeles, Calif., is now marketing a completely new pumping unit for wells as small as 4 in. in diameter. It is called the Verti-Line Package-Pump, because it is pre-engineered for ordering by unit number and delivery as a complete package. There are two sizes—4 in. and 6 in.

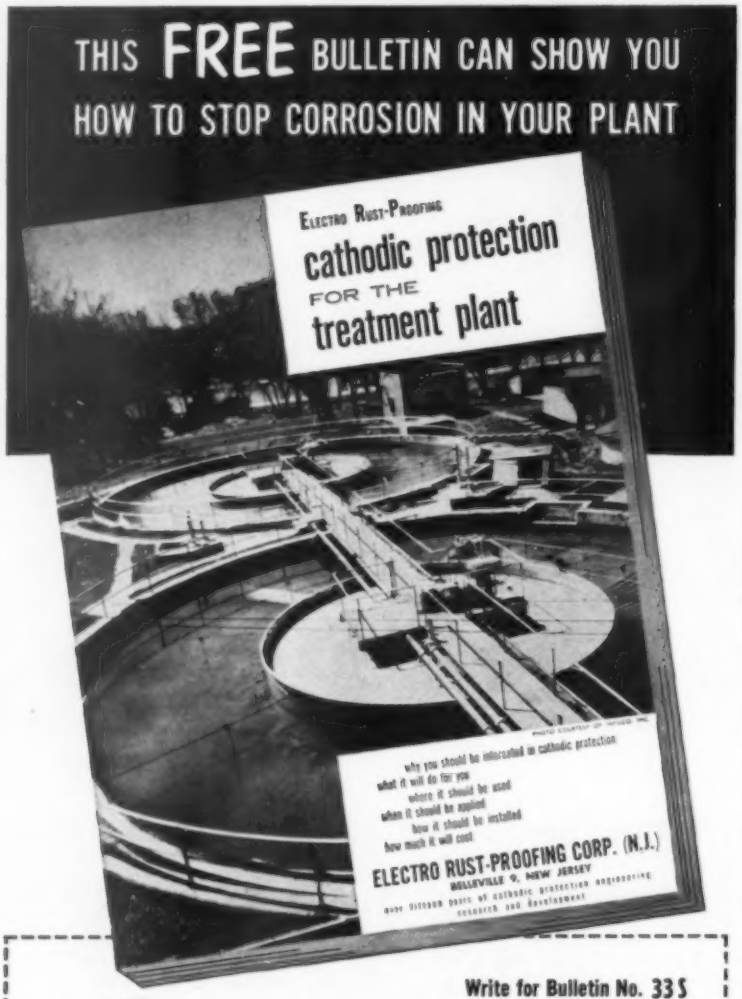
Laboratory tests have resulted in efficiencies over 80%. This remarkable achievement means more water per horsepower, with resulting economies to the user.

Verti-Line Package-Pumps are available in sizes from 2 through 7½ HP; heads to 340 feet; capacities from 200 to 7,500 gal per hr.

Single Unit Prepares And Applies Chlorine Activated Silica
516

Wallace & Tiernan Incorporated, Belleville, N. J., has developed a unit for the continuous preparation and application of activated silica. The "WT Silactor" may be used in all water or waste treatment plants where activated silica can serve as a coagulant aid to improve flocculation or sedimentation. Since the unit uses chlorine as the activant, it is particularly suited to processes where chlorine is used for sterilization or slime control in addition to using activated silica for improved coagulation.

The Silactor method of continuous chlorine activation and application of silica uses both sodium silicate and chlorine directly from their original shipping containers, eliminating the need for intermediate handling, extra storage tanks for materials and large batch-type equipment.


THIS FREE BULLETIN CAN SHOW YOU
HOW TO STOP CORROSION IN YOUR PLANT
ELECTRO RUST-PROOFING
cathodic protection
FOR THE
treatment plant
why you should be interested in cathodic protection
what it will do for you
where it should be used
when it should be applied
how it should be installed
how much it will cost
ELECTRO RUST-PROOFING CORP. (N.J.)
BELLEVILLE 9, NEW JERSEY

Write for Bulletin No. 335

CATHODIC PROTECTION

ELECTRO RUST-PROOFING CORPORATION

30 MAIN STREET, BELLEVILLE 9, N. J.

ATLANTA CHICAGO DALLAS MONROVIA SEATTLE

E-33

Repair Pipe Leaks Quickly, Permanently
517

Atlas Industries, Inc., Houston, Texas, has introduced a new tool that repairs pipe leaks quickly, permanently and economically.

The tool consists of the Atlas pipe clamp and Atlas patches which are accurately shaped to fit specific pipe sizes and assure a skin-tight fit when gasket is compressed. It is made in two styles: the saddle type in four sizes for use on pipe 6 in. in diameter and less; and the chain type in all sizes from 6 in. up to any size. The patches are made of steel with either neoprene or asbestos gaskets.

The clamp is placed around the leaking pipe, without shutting off the line. Patch is applied directly over leak and sufficient pressure applied by the clamp to stop leak. Patch can then be welded to pipe or clamp can be left on until it is convenient to weld the patch. These tools have been tested under pressures to 6000 psi. One man can ordinarily apply the patch in approximately 30 sec.

Smooth-Flo Sewer Pipe

518

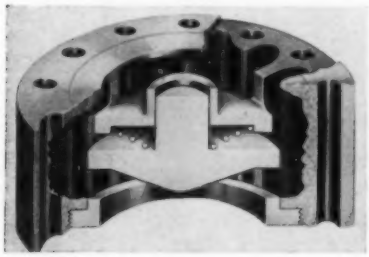
Armco Drainage & Metal Products, Inc., Middletown, Ohio, has developed Smooth-Flow sewer pipe that is said to provide flow capacity equal to or better than any other sewer structure.

The flexible corrugated metal design provides strong joints and strength under the impact and vibration of heavy live loads. To the interior of the pipe, a smooth asphalt lining, centrifugally applied at more than 800 rpm, covers all the corrugations. The asphalt lining withstands heat and cold without melting, cracking or spalling.

Armco Smooth-Flo pipe is supplied in long lengths that can be varied to suit job requirements. And with available diameters ranging up to 84 in. in 6-in. increments. Long lengths, light weight and quick-bolted coupling bands mean fast installations.

Simplified Silent Check Valve

519



The Williams Gauge Co., Inc., Pittsburgh, Pa., has developed a new simplified flanged silent check valve for control of water hammer. The new valve is recommended by the manufacturer for control of water hammer for all types of hot or cold liquid service—including water, oils, gasoline, acids, chemicals, salt water, brine—where flow is constant.

This unit was developed to provide a lower cost Williams-Hager valve without sacrificing water hammer control and durability features. It is available in sizes from 1 to 10 in., faced and drilled in accordance with A.S.A. standard for pressures ranging from 125 to 2,500 psi.

Highpressure Steam Cleaner

520

Homestead Valve Manufacturing Co., Coraopolis, Pa., has developed a new Hypressure Jenny steam cleaner.

Features of the unit are said to include: a new slow-speed positive displacement pump with disc check valves which guarantees extra long service, low maintenance, and a minimum of 120 gal per hr at any pressure; a piano hinged machinery cover for complete and easy accessibility to all working parts; a "no-stoop" control panel; contamination-proof water system; and remote control to stop and start machine at cleaning gun even though operator may be 100 ft or more from unit.

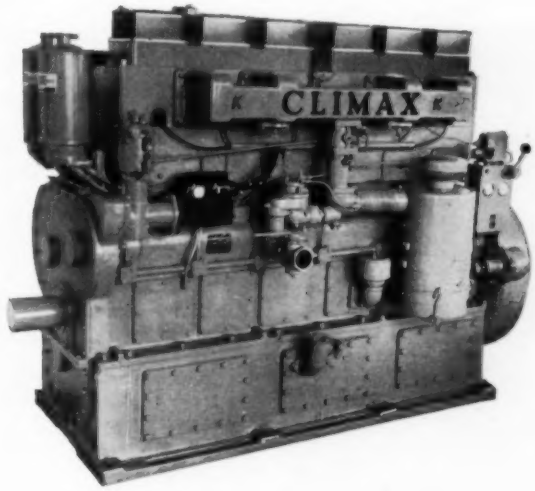
Flush-Feeder For Slurry Pumping

521

Proportioneers, Inc., Providence, R. I., has developed a simple **Flush-Feeder** to effectively handle high concentration slurry solutions and corrosive liquids.

Because of its ability to pump slurries of thin mud-like consistency, a fairly small make-up tank can often hold enough slurry for several days operation, minimizing operator surveillance, and thereby affording important operational economies.

(*Continued on page 124A*)



AN ENVIABLE REPUTATION

Climax sewage gas engines have established a reputation for economy, dependable operation and low maintenance cost, in more than 70 Sewage Treatment Plants from coast to coast.

The late model 6 cylinder, in-line engine pictured here portrays the modern design which, coupled with conservative ratings, moderate speeds and carefully engineered installations, is the basis for this reputation.

The tremendous savings to be made from the use of sewage gas for power and the utilization of heat from jacket water and exhaust for buildings and digestors, make the choice of Climax engines exceedingly desirable.

climax

FOR COMPLETE INFORMATION, WRITE TO . . .

ENGINE AND PUMP MFG. CO.

208 So. La Salle St.

CHICAGO 4, ILLINOIS

Factory—Clinton, Ia. *District Office*—Dallas, Tex.

In the Flush-Feeder, a unique check valve assembly mounted directly on the slurry tank is separated from the metering pump so that slurry cannot enter the primary displacement cylinder. Since only water—or the particular compatible fluid chosen for flushing—passes through the reagent ends of the Duplex Chem-O-Feeder, the detrimental factors which make slurries and corrosive liquids hard to handle are eliminated. The seat of the check valve assembly is flushed clean at every stroke of the pump.

Air Powered Pipe Puller And Pusher

522

The Trojan Manufacturing Company, Troy, Ohio, has recently introduced a new air powered pipe puller and pusher that takes all the hard work out of pushing and pulling operations.

Designed to handle pipe up to 2" in diameter without additional dogs, clamps or wedges—this new air powered model is operated by the simple regulation of a control valve—keeps pipe continuously moving because it requires no time-killing resetting of grip—has three pushing speeds for different types of soil—and can be changed from pushing to pulling position in 30 sec.

Construction features include all steel parts and a special gripping dog with individual, interchangeable inserts for each step. The air cylinder, which measures 26 in. long by 4 in. in diameter, is connected to the control valve by means of quick change air couplings and two 6 ft lengths of rubber hose.

The machine uses 30 in. push pipe and requires only a 5½ ft trench for operation. For easy lifting in and out of the trench, the air cylinder may be removed from the machine by removing a single pin. If so desired, the machine may also be operated by hand.

Clay Pipe Guarantee Upped To 75 Years

523

The Clay Sewer Pipe Association, Columbus, Ohio, has announced the extension of the guarantee on vitrified clay pipe from 50 to 75 years.

All clay pipe manufactured by CSPA members is now guaranteed for three quarters of a century against "impairment of service, injury, or failure which may be caused either by chemical decomposition or chemical disintegration." The guarantee applies whether or not the sewage, drainage, or industrial wastes carried by the pipe contain acids or alkalis, which commonly develop in ordinary household sewage and industrial wastes and are the chief destructive elements in sewerage lines.

CSPA, which operates in the 17 states north of the Ohio River and east of Indiana, is a non-profit organization of clay product manufacturers. Maurice Maskrey, its president, announced that the guarantee extension was based on the performance of thousands of miles of vitrified clay pipe in installations over a 75-year period.

Beaver Pipe Forms New Division & Announces Two New Machines

524

Beaver Pipe Tools, Inc., Warren, Ohio has recently established an Abrasive Machine Division.

With the actuation of the new division, two new Abrasive Cutting Machines have been added to the line. They are the No. 20 Any-Angle Abrasive Speed-Cut Machine and the No. 20 Wet-Cutting Abrasive Speed-Cut Machine. Other models will soon be announced.

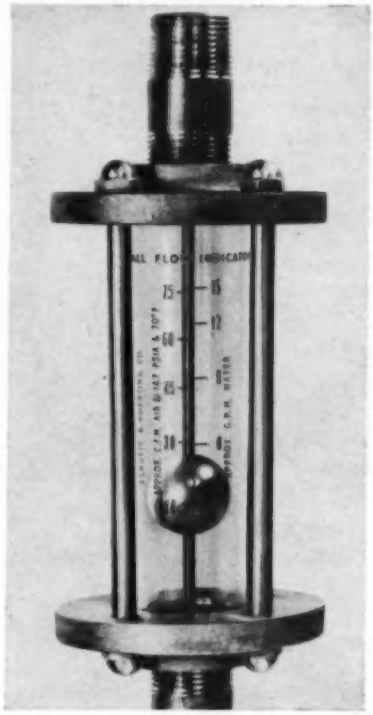
The Any-Angle Cutting Machine uses the No. 20 standard cutting head mounted on a special base with the pivot built into the base. Vise and material remain stationary. Cutting head swivels easily in a 60-degree arc, permitting any angle cut from 30 to 90 degrees. Large figures are stamped in the back edge of arc for correct angle setting. A locking nut holds cutter head securely and accurately in cutting position.

In the No. 20 Beaver Wet-Cutting abrasive Cutting Machine cooling effect of the liquid (water with rust resistant added) produces a polished cut with no burr and insures maximum wheel life.

The machine is equipped with a circulating cooling pump (with separate motor and control). It has a settling tank with two baffles to filter out sediment. Coolant control valve is conveniently located at front of machine.

Dual Scale Flow Indicator

525



Schutte and Koerting Company, Cornwells Heights, Bucks County, Pa., has developed a ball-type Flow Indicator, that provides a dual scale for the approximate measurement of water flow in gpm and air flow in cfm. Thus, this inexpensive but sturdily built instrument for indicating water or air flow and approximate rate of flow is made exceptionally versatile for industrial use.

The ball-type flow indicator uses a ball on a guide rod, installed in a tapered glass tube to indicate flow in a pipe line. When fluid, water or air, flows from the inlet at the bottom to the outlet at the top, it exerts force on the free moving ball

causing it to rise in the tapered tube, higher as the rate of flow of the fluid increases. The position of the ball in relation to the scale graduations gives an approximate indication of the fluid rate of flow.

Bronze Globe Valves
526

The Lunkenheimer Co., Cincinnati, Ohio, has announced a new line of bronze globe valves, rated at 200 lb steam pressure and at 400 lb water, oil and gas pressure.

The bodies and bonnets of the new valves are made of Lunkenheimer S-1 bronze, an original Lunkenheimer development that features high density, strength and corrosion-resistance.

Other features of the line include the exclusive Lunkenheimer "Steamalloy" stem, which minimizes thread wear; the "Non-Slip" easy-to-turn handwheel; hex head gland; deep packing nut for firm thread engagement; large packing box; union bonnet; and back seats which facilitate repacking while the valve is wide open.

Differential Regulator With Integral Needle Valve
527

Conoflow Corp., Philadelphia, Pa., has developed a new differential pressure regulator incorporating a self-contained needle valve.

The Model H-21F differential relay can be used for economical purging with air, water, or gas. in services where actual measurement of the flow is unnecessary. It can also be supplied in combination with a small flow rate indicator as a complete, compact, inexpensive purge meter package. Cost of the differential relay with integral needle valve is about one-half the cost of the standard purge assemblies now on the market.

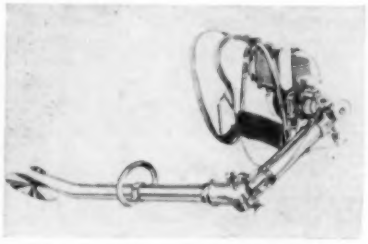
Incubators Have Controls Mounted On Outside Of Door
528

Central Scientific Co., Chicago, Ill., has introduced an improved line of refrigerated incubators which provide easier controls and more constant temperatures.

Principal feature of the improved refrigerated incubator is the location of heating controls and dials. Mounted on the outside of the door, they enable operators to perform all adjustments without opening the door, thereby eliminating temperature fluctuations.

A convenient dial control at eye level permits complete temperature control from 5 to 50 degrees C. Also on the outside of the door is an easy-to-read dial thermometer which shows the exact inside temperature. The new unit will hold 120 bottles of 190-ml size or 105 bottles of 300-ml size. Additional storage space is provided by racks on the door.

New Brush Cutter Saves Clearing Costs
529



The Southworth Machine Co., Portland, Maine, has announced the Southworth Senior Model Brush Cutter that cuts grass, weeds, brush and trees up to 10 in. in diameter—even under water.

Unlike other power brush cutters, this 2.8 hp lightweight machine comfortably fits on the operator's back. This leaves both hands free for cutting and clearing operations and assures perfect balance, firm footing.

Other features of the machine are the saw arm elbow, knee joint and "offset" cutting end. These permit the operator to tilt the saw up, down and sideways in any direction making possible the coverage of a far greater area from one position.

New Valve For Use In Pneumatic Control Systems
530

Industrial Products Div., Westinghouse Air Brake Co., Wilmerding, Pa., has developed a ¼-in. "D" Pilotair valve for use as directional valves, interlocking valves, transfer valves, sequence valves or shutoff valves in pneumatic control systems with pressures as high as 250 psi and temperatures as high as 200°F.

The new, smaller valve has the advantages of being able to be used in a system where not as much air is needed and where the amount of space that can accommodate a valve is a factor.

A unique feature of the "D" Pilotair valve is its sectionalized construction which permits over 3,000 different 2, 3 and 4-way valves to be assembled from a few basic parts. 3 and 4-way valves are built with open exhaust and with tapped exhaust ports. They may be operated manually, pneumatically, mechanically or electrically.

Explosion-Proof Motors
531

Sterling Electric Motors, Inc., Los Angeles, California, now offers a complete line of Explosion-Proof motors through NEMA frames 405 and 215. Sterlings design meets underwriters requirements for the three most common hazardous locations: gaseous, explosive dust, and explosive grain dust.

Sterling explosion-proof motors are specially treated to resist moisture, dust and corrosive atmospheres and feature extra long flame paths at shaft and bracket fits and fully-sealed pre-lubricated ball bearings. Explosion-proof motors are available in standard, geared, or variable speed models, with optional mountings to meet individual requirements.

New Sizes Added In U.S. Line Of Right-Angle Gear Drives
532

U. S. Electrical Motors Inc., Los Angeles, Calif., has announced an increase in available sizes of U. S. Holloshaft right-angle gear drives. Sizes now range from 11 to 150 hp and they are also available in a wide selection of gear ratios and speeds.

The drives are universally adaptable to any vertical turbine pump and are driven by gas, gasoline or diesel engine. Holloshaft gear drive permits the pump shaft to be mounted integrally, assuring highest efficiency and precise adjustment of pump impellers.

Water Analysis Articles
533

W. H. & L. D. Betz, Philadelphia, Pa., have made available a series of articles on **Water Analysis** and its interpretation. The articles, published in the *Betz Indicator,* constitute a helpful series.

W&SW

Manufacturers' News

"Lou" Northrop of Neptune Meter Dies

Neptune Meter Co., New York, N. Y., has announced that Lowell E. "Lou" Northrop died in Los Angeles, Calif. on Jan. 8, 1956. He had been with Neptune Meter Co. 42 years prior to his retirement in 1953 and was widely known in California, Nevada, Oregon, and was secretary of the California Water Association.

Known on the West Coast as "Mr. Water Meter", Mr. Northrop throughout his sales career was active in various professional and technical societies of the region. He was awarded a Life Membership in the Arizona Sewage and Water Works Association.

Born in Reno, Nevada, April 13, 1888, Mr. Northrop was the grandson of early pioneers who came west during the Gold Rush. He attended Troop Polytechnic Institute, which later became the California Institute of Technology. He was active in the steel industry and the engraving business before joining Neptune Meter in 1911.

Delaney Joins Cannelton Sewer Pipe

Cannelton Sewer Pipe Co., Cannelton, Ind., has announced the appointment of J. R. "Ernie" Delaney as promotional engineer, to head its newly created Engineering Service Department.

In his capacity as promotional engineer, Delaney will personally supervise Cannelton's new facility designed to render valuable service to consulting engineers, city engineers and Government engineers, by keeping them informed of the latest developments in plastic and vitrified clay pipe as well as improved methods of jointing. He will maintain headquarters at the company's Cannelton offices.

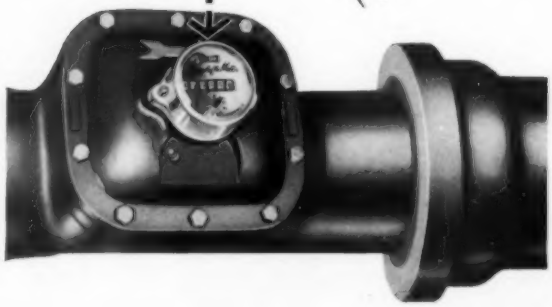
Prior to his affiliation with Cannelton, Delaney was city engineer for the City of Frankfort, Ky. Previous to this, he had served as development and project engineer for Schenley Distilleries.

B-I-F Establishes New Service Names Six Advisory District Engineers for Water and Sewage Field

Consulting engineers, designers, and water sewage works superintendents can now call on Builders-Providence, Inc., Proportioneers,

don't surmise... totalize!

Builders-Providence PROPELOFLO® is a direct-reading, propeller-type meter designed for main line totalizing of water consumption . . . available in 2 to 20 inch sizes . . . with flanged, bell and spigot, and threaded ends. Rated capacities range from 15 to 5800 gpm . . . accurate to within plus or minus 2% of actual flow. For complete information, write to Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.



B-I-F INDUSTRIES

PROVIDENCE, RHODE ISLAND

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC.
BUILDERS-PROVIDENCE, INC. • OMEGA MACHINE CO.

B-I-F METERS FEEDERS CONTROLS

Inc., and Omega Machine Co., Divisions of B-I-F Industries, Inc., Providence, R. I., for services of any of six District Engineers to aid in the solution of problems involving meters, feeders and controls.

Heading this new service is

M. E. Rogers, project sales manager of Builders-Providence, Inc. The six District Engineers are C. K. Perkins (New York City), D. A. Wood (Washington, D. C.), B. E. Hamlett (Pittsburgh), G. E. Riepe (Chicago), E. F. Morey, Jr. (Dallas), and L. H. Chamberlain (San Francisco). Each will serve a regional area of several states. The New England area will be served by engineers in the home office of B-I-F Industries in Providence.

The appointment of these District Engineers marks another step in the program of B-I-F to develop complete specialized services for its customers. These seven men bring to this special service a combined total of more than 115 years of experience in the field of water supply and sewage treatment, particularly in those aspects which deal with metering, chemical feeding, and instrumentation and control.

M. E. "Bill" Rogers, a former water and sewage works superintendent of Wichita, Kan., has devoted 20 years to the field after several years experience in railway engineering. He is the author of several articles on instrumentation and is a member of ASCE, AWWA and other professional organizations.

Carl Perkins will serve the New York Metropolitan area including part of New Jersey, Pennsylvania and Eastern New York State. He has been sales manager of the New York Office and has been an employee of the company, engaged in selling water and sewage works equipment for 30 years. He is a member of ASME, ISA, AWWA, NDHA and NYSIWA.

"Dave" Wood, will serve the East Coast states New Jersey through North Carolina. A mem-

(*Continued on page* 128*A*)

Fordin' Along...

According to the American Society of Civil Engineers the seven wonders of the modern American engineering world include (1) Grand Coulee Dam (2) San Francisco Oakland Bridge (3) The Chicago Sewage Disposal System (4) The Colorado River Aqueduct (5) Panama Canal (6) Hoover Dam, and (7) Empire State Building. Six of the seven have to do with water, and four with its storage distribution or disposal.

Why BREAK YOUR BACK?

When the Ford Lifter Worm Lock is so easy to use

Snow, ice and dirt tending to hold down meter box lids are easily conquered with the Ford Lifter Worm Lock.

This simple mechanism, operating like an auto-jack, has a tremendous lifting force that breaks any seal around the edges of your covers.

It's handy, too, because it locks and unlocks your lid to prevent tampering. It offers extra safety because an unlocked lid is detected at a glance.

The key which operates the Lifter Worm Lock serves as a handle to lift the lid, saving time and keeping hands clean.

Send for complete data and Free Catalog.

THE FORD METER BOX COMPANY, INC.
WABASH, INDIANA

FOR BETTER WATER SERVICES FORD

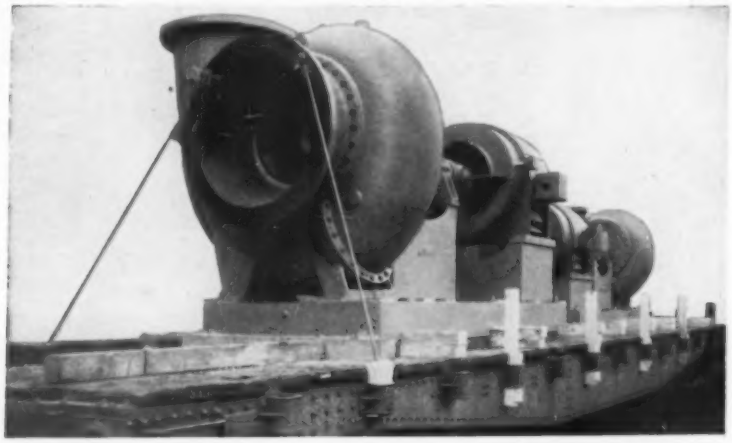
ber of AWWA, "Dave" has been selling B-I-F Industries products and equipment for more than ten years and had earlier training in the manufacturing plant at Providence.

Bruce Hamlett, manager of the Pittsburgh office, is a member of NDHA, Eng. Soc. W. Pa., I.S.A. and AWWA, and has been associated with B-I-F Industries as an engineer for six years. He will cover the area including Western New York, Pennsylvania, Kentucky, Tennessee, West Virginia and Ohio.

"Gerry" Riepe, formerly director of Environmental Sanitation for the State of Colorado and engineer in the Bureau of Reclamation, has been sales manager of the Chicago office for several years. A Lt. Col. in the Sanitary Corps during World War II, he is a member of AWWA, ASCE, NSPE and CSSIWA. His experience spans 22 years. "Gerry" will serve Illinois, Indiana, Michigan, Minnesota, Wisconsin, Missouri, Kansas, the Dakotas, Nebraska, Colorado, Wyoming and Montana.

"Ed" Morey has been manager of the Dallas office of B-I-F Industries since 1954 and for eight previous years was a sales engineer in the firm of Morey and Morey, B-I-F Industries agent in the Southwest. He is a member of AWWA, FSIWA, and a registered professional engineer in Texas. "Ed" will be on call in Texas, Oklahoma, Louisiana, Mississippi, Arkansas and New Mexico.

"Lee" Chamberlain, president of Builders-Pacific Inc., has spent more than 20 years selling equipment in the water and sewage works field before joining B-I-F. He is a member of ASME, AWWA, ISA and FSIWA. "Lee" will serve the field in California, Oregon, Washington, Idaho, Utah, Nevada and Arizona.



THESE WHEELER-ECONOMY PUMPS HOLD CONSTANT LEVELS IN THE NEW TRICKLING FILTERS AT DALLAS' WHITE ROCK PLANT

Two of the Wheeler-Economy pumps installed in the White Rock Sewage Treatment Plant for Dallas, Texas are believed to be the largest ever operated through magnetic couplings. In order to maintain constant levels in the suction wells and grit channels, each of the two units driven through magnetic couplings are governed by an elaborate float level control. This helps the big Wheeler-Economy pumps to maintain level within predetermined 6" limitations. Total pumping capacity of the four Wheeler-Economy pumps installed at the White Rock Plant is 134 million gallons a day.

WHEELER-ECONOMY HORIZONTAL, MIXED FLOW RAW SEWAGE PUMPS AT INSTALLATION

Rely on Wheeler-Economy for help in complex pumping problems, dependable delivery and performance that lives up to promise.

Wheeler-Economy Pumps in Operation at Dallas' White Rock Plant

- 24" suction x 24" discharge variable speed pump driven through magnetic coupling by a 250 HP, 2300 volt horizontal electric motor. Capacity 20,000 gallons per minute at 40' total dynamic head.
- 24" x 20" variable speed pump, driven through magnetic coupling by 200 HP, 2300 volt motor. Capacity 13,000 GPM at 40' TDH.
- 42" x 36" constant speed pump, driven by 400 HP, 2300 volt motor. Capacity 40,000 GPM at 37' TDH.
- 24" x 20" constant speed pump, driven by 200 HP, 2300 volt motor. Capacity 20,000 GPM at 37' TDH.

WEB25

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. - DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.

Halvorsen Joins Plastic Pipe Division of Orangeburg Mfg.

Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y., has announced that John J. Halvorsen,

formerly technical director of plastic pipe and fittings for Continental Can Co., has joined the company as manager of sales and development of the company's new plastic pipe division.

Prior to his association with Continental Can Co., Mr. Halvorsen was affiliated with Crane Co., from 1928 to 1954 during which time he served as supervising engineer of metal and plastic pipe, fittings and flanges.

Infilco Starts Company In Australia

Infilco Inc., Tucson, Arizona, has announced the formation of an Australian subsidiary with offices in Sydney. This becomes Infilco's third foreign subsidiary, the other two being located in Mexico and Canada. A fourth subsidiary is in process of formation in Japan.

Mr. Stanley D. Heden has moved his family to Sydney to assist in the organization of the new subsidiary and to supervise its oper-

ation. Mr. Heden is a chemical engineer who has been associated with Infilco for seven years. He has had varied experience in numerous departments of the company and is well qualified for his foreign assignment. Under present plans Mr. Heden will remain in Australia for approximately 18 months, at which time he will return to Tucson and will be replaced by Mr. Peter Squires, an Australian engineer.

Fairbanks, Morse Announces Passing of T. E. Woodruff

Fairbanks, Morse & Co., Chicago, Ill., has announced that Mr. T. E. Woodruff, Manager of the Pump Sales Division, passed away in Alexian Brothers Hospital in Chicago, February 26, 1956.

Mr. Woodruff had been a long time employee of Fairbanks, Morse, having started with that organization in 1912. For the past several years he was located at the Kansas City, Kansas Pump Works of the Company.

Homestead Valve Expands Plant

Homestead Valve Manufacturing Company, Coraopolis, Pa., has started the expansion of its main plant on route 51, Moon Township, Pa.

The company's building and modernization program includes new and more productive machinery and equipment for their foundry and machine shops. In addition to increased output, the program will provide better and more efficient materials handling and shipping facilities.

A. Y. McDonald Mfg. Co. Enters 100th Year

The A. Y. McDonald Mfg. Co., Dubuque, Iowa, has announced the celebration of its Centennial Anniversary this year.

The company was founded in Dubuque by A. Y. McDonald in 1856. From a modest machine shop turning out hand pumps, the manufacturing facilities have grown to a plant that covers 5½ acres of ground and employs 510 people.

(*Continued on page* 130*A*)

SNUG TO THE WALL of a railroad underpass is the trench being dug by this compact Cleveland "Baby Digger." Its ability to put the edge of a trench within less than two feet of a parallel wall is but one of this Cleveland's many practical operating advantages.

DIGGING CLEAN AND FAST the same Cleveland "Baby Digger" turned out high daily production on this job. With more than 30 usable digging speeds at the operator's command, the Cleveland cut cleanly through pavement and heavy root growth for trench 22 inches wide by 41 inches deep.

Talk it over with your Cleveland distributor

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

The factory contains 310,000 square feet, with some of the most modern foundry and machine equipment to be found in the Middle West. New core ovens and modern electric furnaces have been recently added to increase production.

The Wholesale Division, now headed by J. M. McDonald, Jr., opened its first branch house at Omaha, Nebraska, in 1915. Eighteen others have been added since, serving Midwest America from Canada to Mexico, from Illinois to Colorado. The Wholesale Division employs a total of 805 people.

A. W. Lewis Of U. S. Pipe Retires

United States Pipe and Foundry Company, Birmingham, Alabama, has announced the retirement of A. W. Lewis, Cleveland sales agent for the company.

Mr. Lewis has been with U. S. Pipe for 40 years. Starting in the Cleveland pipe shop in 1916, he worked in various capacities and was resident manager of the plant for two years before it was closed in 1930. From that time on he handled sales in the Cleveland office territory.

Timothy J. O'Shaughnessy has been appointed sales agent at Cleveland to succeed Mr. Lewis. Mr. O'Shaughnessy served in the Navy during World War II and attended Northwestern University. He came with U. S. Pipe in 1954 and was located in the Chicago sales office until his transfer to Cleveland.

Louis F. Frazza Appointed Director BSDA Water & Sewerage Division

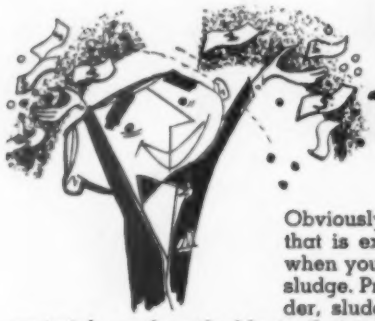
Louis F. Frazza, Hawthorne, N. J., an executive of the Johns-Manville Sales Corporation, and on loan to the Government from the company, has been appointed Director of the Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, U. S. Department of Commerce.

Throughout his business career, Mr. Frazza has specialized in water and sewerage construction and engineering, and related activities. His acceptance of the appointment brings to the BDSA current expert knowledge of the field. The Government training provided by his work with the Division will prove invaluable should his services be made available in any future emergency.

Earnshaws Docks To Represent Dorr-Oliver In Philippines

Dorr-Oliver Incorporated, Stamford, Conn., has announced the appointment of The Earnshaws Docks and Honolulu Iron Works of Manila as its exclusive representative in the Republic of the Philippines. Earnshaws, which has handled the sale of D-O cane sugar clarifiers for a number of years, will now both market and locally manufacture the complete line of Dorr-Oliver equipment and services.

As a result of this new representative arrangement, the sale of all D-O equipment in the Philippines has been centralized with a single organization fully equipped to manufacture locally. In the Port Area of Manila, Earnshaws main-



CAN YOU AFFORD TO THROW MONEY AWAY?

Obviously, the answer is "no". But that is exactly what you are doing when you burn or bury your sewage sludge. Prepared with a Royer Shredder, sludge is a valuable fertilizing material, easily saleable to florists, nurserymen, golf courses and gardeners. By making this product available to your community you are doing them a service and at the same time earning a cash return.

The operation is simple. Sludge cake direct from the drying beds is fed into the hopper of the Royer Shredder where it is shredded, mixed, aerated and discharged to bag, pile or truck . . . free of all trash, ready for use. Low capacity, hand fed units are available for small operations . . . huge, bucket loaded 150 cubic yard per hour models for larger disposal plants.

Don't throw money away . . . either by unnecessary disposal costs or by failing to sell a wanted product. Send for Bulletin 55-S giving complete information on the Royer Shredder and its use in sewage sludge disposal.

ROYER foundry & machine co.

170 PRINGLE ST., KINGSTON, PA.

ROYER

tains extensive manufacturing facilities including a foundry and pattern, machine, plate and assembly shops.

J. F. Byers Elected President of A. M. Byers

A. M. Byers Company, Pittsburgh, Pa., has announced that J. Frederic Byers, Jr., formerly executive vice-president, has been elected president.

He succeeds A. B. Drastrup, who resigned as president and a director to accept an executive position with another company.

Mr. Byers has been with the company since 1937, serving in various sales, administrative, and executive capacities. He became a director in 1939, assistant to the president in 1949, and a vice-president in 1954. He is a grandson of A. M. Byers, the founder of the 92-year-old company, and son of the late J. Frederic Byers, Sr., chairman of the company at the time of his death in 1949.

Mr. Drastrup has been president of the A. M. Byers Company since 1954. He joined the company in 1931 and rose successively through the positions of manager of steel sales, assistant to the president, and executive vice-president.

Pennsalt Promotes Shera

Pennsylvania Salt Manufacturing Co. of Washington, Tacoma, Washington, has announced the appointment of Brian L. Shera to Assistant Sales Manager.

Shera, a University of Washington graduate chemical engineer started his

(*Continued on page* 132*A*)

POSITIONS AVAILABLE

SUPERINTENDENT $5500-$7000; CHEMIST $4500-$5500; MAINTENANCE SUPERVISOR (for mechanical and electrical equipment) $4500-$6000 and OPERATORS $3900-$4800 for new 18 MGD high-rate trickling filter sewage treatment plant to be placed in operation July 1, 1956. Positions available June 15, 1956. Vacation and sick leave benefits. Send resume of experience and minimum acceptable starting salary to City of Alexandria, Virginia, Sanitation Authority, 113 North St. Asaph Street, Alexandria, Virginia.

GET EXTRA DIGGING SPEED

With Hydrohoe's Triple-Action Bite

The Bucyrus-Erie Hydrohoe gives you three separate digging motions that boost output—give you unmatched digging control.

THE PRIMARY DIGGING FORCE is applied by means of a powerful hydraulically-operated ram. The dipper is pushed through the conventional dragshovel digging arc — no drag rope, dipper bail or sheaves which can interfere with loading.

A SECONDARY DIGGING AND POSITIONING FORCE is obtained through 3-foot extend-retract action of telescoping boom. This not only permits operator to wedge dipper against bank so as to dig sharp corners, but also to level trench floors and to dig around obstacles. Move-up time is reduced by as much as 40 per cent.

STILL ANOTHER AND EXTREMELY IMPORTANT DIGGING FORCE is the Hydrohoe's powerful wrist action dipper which increases digging force as much as 50 per cent. Also, the dipper can be positioned so that teeth bite in at best angle — and rotated so that dipper can load quickly, and be in "face-up" position during swing to prevent spillage.

Complete hydraulic control of all digging actions gives operator the control that helps avoid damage to buried pipe and cable.

Your Bucyrus-Erie distributor will be happy to demonstrate the H-3 Hydrohoe. Also ask him about Hydrocranes. 118H56

BUCYRUS ERIE

SOUTH MILWAUKEE, WIS.

20 years service with Pennsalt as a chemicals salesman and soon after became Assistant Superintendent of the Tacoma plant. Later, as a Technical Sales Engineer, Shera assumed management of Pennsalt's Western Sales Services until his appointment as Manager, Technical Services in 1954.

Widely known in Western pulp and paper industries, Shera has also been active in TAPPI, water treatment problems, American Institute of Chemical Engineers, Chlorine Institute matters, as well as in the field of horticulture as a hobby.

Rockwell Names Carson District Sales Manager

Rockwell Manufacturing Company, Pittsburgh, Pa., has announced that Thomas O. Carson, formerly manager — distributor sales and assistant product manager — Nordstrom valves, now heads the division's district sales headquarters offices in Pittsburgh.
a water meter salesman in 1935. He later traveled Mexico, Cuba, Puerto Rico and Canada as a sales engineer in the subsidiary Rockwell International Corporation.

From 1949 to 1954 he managed the International Department of the New York district sales office—then was transferred to Pittsburgh as assistant product manager of Nordstrom valves. In 1955 he was also named manager of distributor sales.

Pa. State Chamber of Commerce Elects Rockwell President

Rockwell Manufacturing Company, Pittsburgh, Pa., has announced that Willard F. Rockwell, Jr., President of the company, has been elected President of the Pennsylvania State Chamber of Commerce for a one-year term.

Also a vice-president of the Pittsburgh Chamber of Commerce, Mr. Rockwell becomes the 10th president of the Pennsylvania's 39-year-old State Chamber, which has a membership of more than 4,000.

Cochrane Forms Canadian Subsidiary

Cochrane Corporation, Philadelphia, Pa., has announced that Cochrane Water Conditioning Limited has assumed engineering, manufacturing and sales activities in Canada as a subsidiary. Through a mutually agreeable arrangement Canadian General Electric Company Limited, representatives of Cochrane Corporation, has ceased its activities as representatives.

General offices of Cochrane Water Conditioning Limited are at 940 Lansdowne Ave., Toronto 4, under Mr. Murray Dobier, Vice President and General Manager, Mr. V. C. German, Sales Manager, and Mr. J. F. Hayward, Sales Engineer.

Mr. R. G. Riddell, Sales Engineer, will be in charge of a district office at 1010 Beaver Hall Hill, Montreal, Quebec. Exclusive representative for the company in the Province of British Columbia is C. C. Moore & Co., Engineers, Vancouver 2, B. C.

Robinson Clay Products Cites Two For Long Service

The Robinson Clay Products Co., Akron, Ohio, currently observing its 100th anniversary, has honored A. E. Williams, sales manager of the Vitrified Division, for 40 year's service; and H. B. Bixler, resident manager of the Akron Branch, for 35 year's service.

Williams, a native of Rochelle Park, N. J., first became associated with Robinson in 1916 and served in various capacities with branch offices. He

ADD POWER
and Multiply Sewer-Cleaning Speed

WITH "FLEXIBLE" POWER DRIVE!

A modest investment in a "Flexible" Power Drive gives you these advantages:

- You can clean sewers *five times faster* with less worker fatigue.
- The Power Drive will easily repay its cost in less than six months.
- Speeding up the immediate job releases your crew to engage in sewer maintenance . . . minimizing emergencies and overtime.

Pat. No's. 2-110,202 • 2,471,060

FLEXIBLE INC.
3786 Durango Ave., Los Angeles 34, Calif.
(Distributors in Principal Cities)

Our representative in your territory will be glad to call and give you more facts about the Power Drive—just one of many Flexible original developments making for faster, safer, more economical sewer cleaning. Or, write for catalog 55-A.

was transferred to the Akron office and made sales manager of the Vitrified Division in 1950.

Bixler has been associated with the Clay Industry since 1917, first as a cashier with the American Sewer Pipe Co. A native of Cuyahoga Falls, Ohio, he joined Robinson in 1921.

Pantech Appoints Hart Director Industrial Wastes Division

Pantech, Inc., Folcroft, Pa., a wholly-owned subsidiary of Pittsburgh Pipe Cleaner Company, has announced that Dr. W. B. Hart has been named Director of the Industrial Wastes Engineering Division of the company.

For more than 30 years Dr. Hart directed the activities of the Waste Control Division of the Atlantic Refining Company. He is the only active member of the original committee for Disposal of Refinery Wastes of the American Petroleum Institute which was organized in 1930. Dr. Hart served as chairman of that committee from 1940 to 1946.

Byron Jackson Names Vonnegut Southeastern Regional Manager

Byron Jackson Pump Div., Borg-Warner Corp., has announced the appointment of A. F. Vonnegut as

Mr. Carson joined the company as Southeastern Regional Manager.

"Al" Vonnegut started with Byron Jackson 26 years ago and has been in Los Angeles sales and regional manager of San Francisco. Prior to the present appointment he was general manager of Butte Pump and Motor Works, Chico, Calif., which is a wholly owned subsidiary of Byron Jackson.

Pleuger Pumps Adds Two New Sales Representatives

Pleuger Submersible Pumps, Inc., Lancaster, Pa., has announced the addition of Stanley A. Stark and Donald Scott as sales representatives of the company.

Stark, who is a graduate mechanical engineer, brings 15 years experience in the industrial and domestic pump field to his new post. He will represent Pleuger Submersibles in the Northeast.

Scott joins the Pleuger organization with five years experience in the in-

(*Continued on page 134A*)

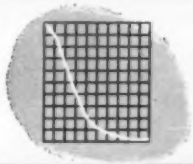
SMS ROTOVALVES

—STILL THE BEST VALVE YOU CAN BUY

Only Rotovalves give you all these features:

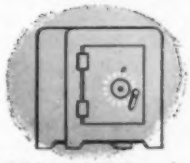
LEAST PRESSURE LOSS
Full line opening means less head loss, lower pumping costs.

EASIEST TO OPERATE
Hydraulic imbalance and mechanical design mean 1 man can close as fast as required. Less power needed in mechanical or electrical operation.



GREATEST INITIAL SHUT-OFF
Rotovalve 55% closed at 25% stroke, and 92% closed at 50% stroke. In comparison, gate valves only 18% closed at 25% stroke and 43% closed at 50% stroke.

MOST CONTROLLED CLOSING TIME
Closing as quickly as one second or as slow as needed. Fast initial closing limits reversal of flow.



MOST POSITIVE CLOSING
Drop-tight, positive closing. Self-purging, monel-to-monel seating. Pressure-tight bolted head, stuffing box, and machined and lapped seats.

In addition to all these features typical of SMS engineering, Rotovalves have a flexibility that makes them suitable for any type of operation, any method of control, or any sort of location.

For detailed information about SMS Rotovalves, Ball or Butterfly Valves, see our local representative or write to the S. Morgan Smith Company, York, Pennsylvania.

HYDRAULIC TURBINES · GATES & HOISTS · PUMPS · TRASH RAKES · ACCESSORIES

HYDRODYNAMICS

ROTOVALVES · BALL VALVES · BUTTERFLY VALVES · FREE-DISCHARGE VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED • TORONTO

"Blow-Up Proof" Filter Bottom with UNIFORM Distribution

Criscrete

. . . Not a block system, but a span of reinforced concrete over entire filter bottom and only 6" deep. Easy installation and proven economy.

Write for field test data, installation list and brochure on Criscrete underdrain system.

M-C-G Company, 1771 W. 5th Ave., Columbus 12, Ohio

modern WAY TO WIN THE BATTLE OF THE ALGAE!

Kills algae in lakes, ponds, swimming pools in *minutes*...

BERKITE #13

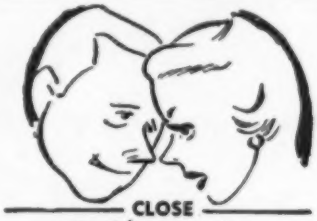
Berkite #13 is fast . . . economical . . . effective! Modern anti-algae "wonder-drug", when used according to simple directions, won't harm fish, birds, domestic animals or swimmers. Destroys algae spores and even heavy growth of algae slime. One gallon Berkite #13 is enough for one million gallons of water. Remains effective at least a month. Modern has a complete line of guaranteed algae preventives, chemicals and testing equipment. See your classified telephone directory for nearest distributor, or write us. Ask for FREE Catalog No. 15-S

modern GIVES YOU SO MUCH more...

modern SWIMMING POOL CO., INC.

Manufacturers of Swimming Pool Supplies Since 1935

One Holland Avenue, White Plains, N. Y.



CLOSE *to things in* Cleveland

Conveniently located in the heart of downtown Cleveland—just minutes away from everything.

800 beautifully decorated, spacious rooms and suites—each with private bath and radio. Six outstanding restaurants and bars.

Excellent facilities for Conventions and Special Events.

Garage open 'round the clock.

Room Rates from $4

Hotel Hollenden

Cleveland's Most Interesting Hotel

Superior Avenue and East Sixth Street

ROBERT P. JOYCE General Manager

Phone: MAIN 1-4700

dustrial and domestic pump industry. He will represent Pleuger in the Midwest and plans to reside in Madison, Wisconsin.

Thompson Joins Blackburn-Smith

The Blackburn-Smith Division of Condenser Service & Engineering Co., Hoboken, N. J., has announced the appointment of Leon D. Thompson as Filtration Engineer.

Mr. Thompson, a graduate of Stevens Institute of Technology, 1914, was associated with United Filters since 1918. Later, he was Export and Sales Manager for the Oliver United Company and recently was Filtration Specialist with Dorr-Oliver, Inc., Stamford, Conn.

Graver Appoints Duff Assistant Technical Manager

Graver Water Conditioning Co., New York, N. Y., has announced the appointment of Mr. Joseph H. Duff as Assistant Technical Manager.

Mr. Duff, a graduate chemical engineer from Newark College of Engineering, has been with Graver's Technical Department for the past seven years. During that time he participated in the development of many of Graver's products in the industrial and municipal water treatment and industrial waste treatment fields. Mr. Duff, who has a wide experience in both the practical and theoretical phases of these fields, is the co-author of several papers presented before leading technical societies.

Hooker To Build Chlorine-Caustic Soda Plant In Western Canada

Hooker Electrochemical Co., Niagara Falls, N. Y., has announced plans to construct a $11,000,000 chlorine-caustic soda plant for Hooker Chemicals Ltd. It is scheduled for operation early in 1957.

First such plant on the Western Canadian seaboard, it will occupy 100 acres of land on deepwater at Burrard Inlet, east of the Second Narrows Bridge near Vancouver. The new plant will employ about 100 people and was engineered by Hooker.

Hooker Electrochemical has just developed the Type S 3-B electrolytic cell to produce chlorine and caustic soda. This will be the first Hooker

plant to use these cells. The new cells permit operation at 30,000 amperes rather than 27,000 amperes, thus raising output per cell with no increase in floor space.

Evans Pipe Expands Facilities

Evans Pipe Co., Uhrichsville, Ohio, has announced the expansions of its production facilities, including the installation of additional and the newest in de-airing equipment.

According to the company, the most modern de-airing equipment assures denser, stronger and truer clay pipe. The de-airing process removes all air from the wet clay by powerful vacuum, thereby reducing absorption.

Another phase of Evans' expansion in 1956—Evans' Golden Anniversary—is the introduction of "Doublength" clay pipe. "Doublength," produced in 3 and 4 ft lengths and in diameters from 8 to 30 in., will be available early in the Spring, in both standard and extra-strength.

Johns-Manville To Build Transite Pipe Plant Near Stockton, Calif.

Johns-Manville Corp., New York, N. Y., has announced that it will build a new plant to manufacture Transite asbestos-cement pipe products near Stockton, California.

The Stockton plant, which initially will employ about 350 people with an annual payroll of $1,500,000, will cover about 225,000 sq ft of operating space. Construction will begin soon with completion expected by the middle of 1957.

In another West Coast area expansion move, Johns-Manville announced earlier this month that it had signed an option on a large gypsum deposit near Las Vegas, Nevada, and is considering entering the gypsum business.

Dr. Sibeud Joins Rhodia, Inc.

Rhodia, Inc., New York, N. Y., has announced that Dr. Jacques P. Sibeud has been appointed Manager of Laboratories.

A native of Toulon, France, Dr. Sibeud attended the University of Lyon and graduated with a degree of Ingenieur E.S.C.I.L., which is equivalent to a B.S. degree in Engineering Chemistry in the United States. He took a post-graduate course at the same university and obtained a PhD. in Chemistry in 1952.

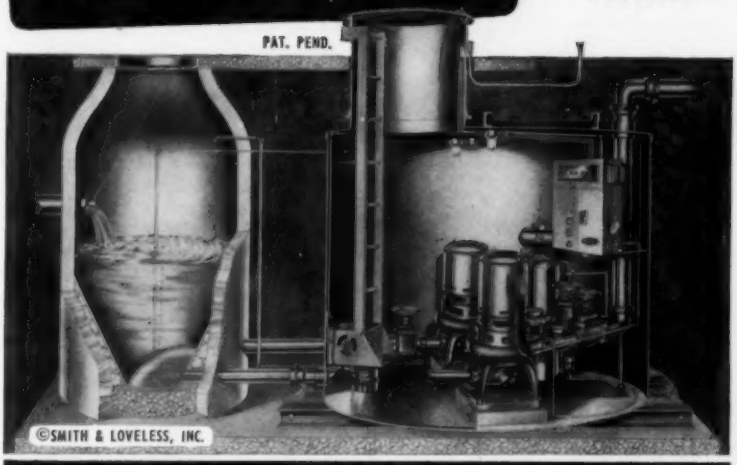
Dr. Sibeud then joined Rhone-Poulenc, Paris, where he was thor-

(*Continued on page* 136*A*)

HUNDREDS OF INSTALLATIONS—IN 27 STATES!

Specify—
The Smith & Loveless
FACTORY-BUILT PUMPING STATION

PROVEN QUALITY—WITH FACTORY-BUILT SAVINGS



THE MOST ADVANCED DESIGN IN SEWAGE PUMPING STATIONS

We specialize in building America's finest sewage lift stations. Acceptance proves their quality. Smith & Loveless offer you a complete line of six standard size lift stations with capacities from 20 GPM to 1600 GPM per pump or ejector. Larger capacity stations are built to your order.

- An integrated design, each piece proven by the test of time.
- Precision assembled by factory experts.
- Automatic dehumidifier to eliminate condensation.
- A central electrical control cabinet prewired and color coded.
- Shot blasted steel structure epoxy coated plus cathodic protection.
- Factory tested and adjusted by actual operation before shipment.
- Easily and quickly installed.
- Especially designed for minimum maintenance.

For Job Recommendations, complete specifications, and drawings—all part of the latest edition of the 100 page Smith & Loveless lift station Data Manual . . .

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How to
CUT COSTS
and get better
SEWAGE EJECTION
told in BULLETIN S-50
by BLACKBURN-SMITH

Blackburn-Smith Mfg. Co.
57 Garden Street, Hoboken, N. J.
I want to know how I can get better sewage ejection at lower cost.
Name .....
Company .....
Address .....

Eliminate complex piping . . . do without screens, impellers, and shredders that need constant, costly cleaning . . . get dependable, automatic operation . . . in short, get better sewage ejection for less money. You'll find out how in Blackburn-Smith Bulletin S-50 which the coupon will bring you. These time-tested pneumatic sewage ejectors have float and electrode controls, and a snap-action valve that's both float and pneumatically controlled.

For details about the BEST in modern sewage ejection, mail the coupon today.

Blackburn-Smith Mfg. Co. Inc.
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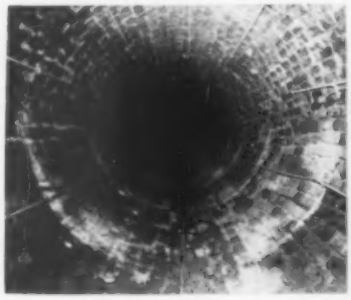


"GUNITE" STRENGTHENS EXISTING SEWERS

Reinforced "GUNITE" lining has been successfully used on brick, tile and concrete sewers, restoring them to greater than originally designed strength.

Erosion of mortar joints and dislodged bricks made many sections of the above 65-year-old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining without opening the streets. Sewer service was maintained by installing temporary flumes and also by bypassing through relief sewers.

This job, and many other types of "GUNITE" jobs which we have done, are illustrated and described in our new 64-page general bulletin C3000. A request on your letterhead will bring you a free copy by return mail.

We will be pleased to cooperate with you on any of your problems.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.
MANUFACTURERS OF THE "CEMENT GUN"

oughly trained in the field of synthetic aromatics through development, control and research work. He was associated with Rhone-Poulenc until his transfer to Rhodia. Dr. Sibeud is a member of the Societe Chimique de France.

Hills-McCanna Expands

Hills-McCanna Company, Chicago, Ill., has announced acquisition of a twenty acre tract in the Village of Carpentersville, Illinois, for the purpose of expanding their Chicago area manufacturing facilities.

A plant of over 100,000 sq ft of industrial capacity will be built on this site to house the company's Products Division. This Division manufactures diaphragm valves and chemical metering and proportioning pumps principally for the processing industries. The new plant will not only permit expansion of production to meet the growing demand for the Division's products, but will also allow consolidation of activities now being conducted at two locations. It is planned to house engineering and production planning services as well as manufacturing facilities in the new plant.

Leeds & Northrup Advances Four In Sales Department

Leeds & Northrup Co., Philadelphia, Pa., has announced four changes in sales management positions.

Edwin A. Yeo, formerly manager at Pittsburgh, becomes manager of the larger office at Chicago. Willard H. Neu, formerly manager at Cincinnati, advances to manager at Pittsburgh. Manley S. Nolen, formerly a sales field engineer at Pittsburgh, becomes manager at Cincinnati. Thomas C. Bennett, formerly manager at Chicago, moves to the position of technical assistant for resale at Philadelphia.

Promotions At Darling Valve

Darling Valve & Manufacturing Company, Williamsport, Pa., has announced, following a meeting of the board of directors, several important changes within the company. These are:

Carl H. Simon elevated to the

position of Vice-President and General Manager. In this position Mr. Simon assumes full responsibility for all Darling Valve operations.

Dick F. Sable assumes the position of General Sales Manager. Mr. Sable was formerly Southwest Regional Manager, and came to Darling from Magnolia Petroleum Research in 1945. He will retain his offices in Dallas, Texas, where the Southwest Regional Headquarters are located.

Thomas C. Jester to Chief Engineer. Mr. Jester was formerly Assistant Chief Engineer, and came to Darling Valve from General Electric in 1945 as Metallurgical Engineer.

James N. Elwood, former Plant Manager and General Superintendent, to Manager in Charge of Manufacturing. Mr. Elwood joined Darling in 1945.

Packer B. Young, former Assistant Sales Administrator, to Assistant Sales Manager.

Rhodia Moves New York Offices

Rhodia, Inc., New York, N. Y., has moved to new and larger offices with improved facilities at 60 East 56th Street, New York 22, N. Y. The move allows for expansion of Rhodia's Aromatics, "Alamask" and other divisions, and will enable the company to give more rapid handling of customers' requests and orders.

Bristol Appoints New District Managers

The Bristol Company, Waterbury, Conn., has announced the appointment of two new district managers.

L. B. Lumpkin has been named manager of the company's Pittsburgh office, after having spent seven years as manager of the Birmingham office. He joined Bristol's sales organization in 1937, in New York, after working for National Aniline for four years.

Mr. Lumpkin holds a B.S. degree in Chemical Engineering from North Carolina State College, where he graduated in 1933.

W. C. Peterson will be taking over the managership of the Birmingham office. Mr. Peterson has spent ten years with Bristol's New York sales force. Previous to that, he was an instrument field service man, also in New York, for six years.

Meet AWWA Specifications* for Tight Closure

at Maximum Shut-off Pressures of 25, 50 and 125 psi

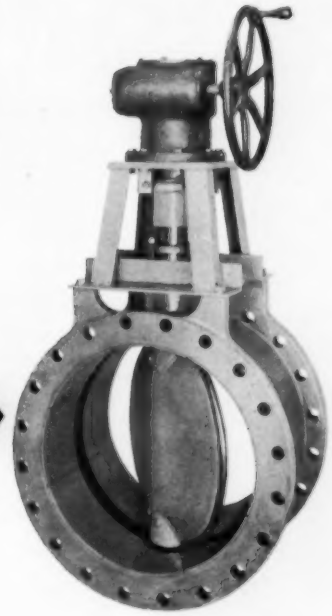
with your choice of

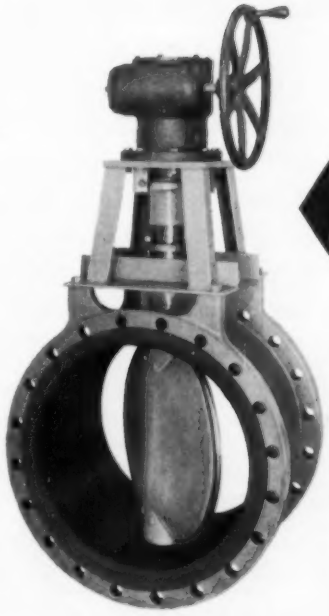
W. S. ROCKWELL

Flanged-End

BUTTERFLY VALVES

Rubber-Seated





Rubber-Lined

Both types in all sizes to 72". Manual operators – gear reducer with hand wheel or chain wheel; automatic operators–electric, hydraulic or pneumatic; for safe seating and unseating of valve disc at water velocity of 8 and 16 f.p.s.

A standard line of valves in sizes to 144" is available for other industrial, municipal and utilities requirements for tight shut-off or regulation of fluid flow. Write for Catalog.

*AWWA C-504-55T

W. S. ROCKWELL COMPANY

ROCKWELL SINCE 1888 BUILT

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

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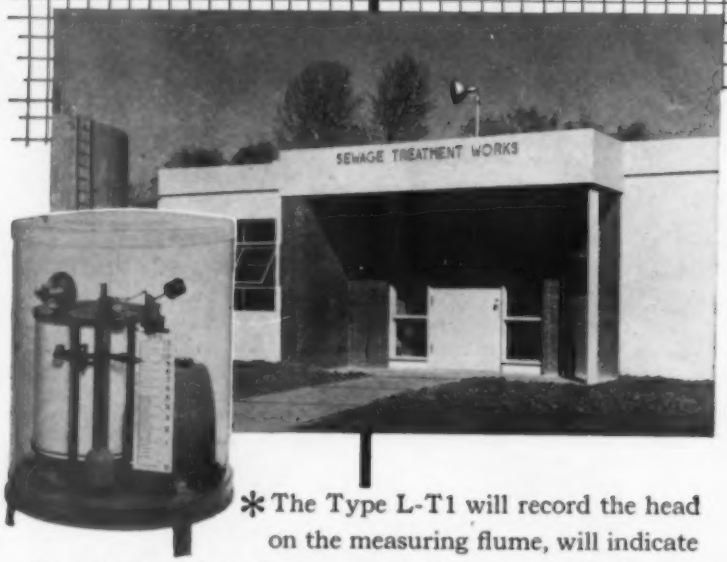
Sales Representatives in Principal Cities

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

PROBLEM:
To obtain at minimum cost the essential information on flow required for efficient operation of a small sewage treatment plant.

SOLUTION:
Stevens Type L-T1 Recorder*



*The Type L-T1 will record the head on the measuring flume, will indicate the volume of flow for any time interval and will give an instantaneous reading of the rate of flow. The head record, made on convenient rectangular coordinates, is basic information for permanent record from which plant operators and State Sanitary Engineers can check flows and volumes. The volume reading from the totalizer dials and the rate of flow indicator are essential for intelligent operation. Readings can be made in any desired volume and flow units.

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144 pages of technical data on recorder installations...plus a wealth of hydraulic tables and conversion tables. **Send $1.00 (No C.O.D.'s)**

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Foremost in Precision Hydraulic Instruments Since 1907

Literature & Catalogs

Test Equipment For Protective Electrical Devices
534

The Multi-Amp Corp., Newark, N. J., has just released a bulletin which summarizes the importance of thorough electrical maintenance and describes new **Testing Equipment** for assuring the proper performance of current actuated protective devices.

A discussion of the incidence of industrial fires directly traceable to malfunctioning electrical protective devices is followed by a description of the types of Multi-Amp equipment available to the electrical maintenance supervisor for preventing equipment failure or outages by preliminary and running safety checks. A recommended procedure of improving maintenance practice by implementing a test record system is also described.

Manual On Electric Plants
535

International Fermont Machinery Co., Inc., Ramapo, N. Y., has just published an 8-page manual entitled **"Engineered Kilowatts"**, and embodying a new concept in the field of electric plants.

The new manual incorporates valuable reference material, forms, and check lists essential to architects, engineers, contractors, and others professionally interested. Among the data the new manual discusses are: selection factors (for an emergency standby electric plant) based upon thousands of case histories; typical specification; and a list of available data covering such items as installation and automatic starting controls.

How To Figure True Piping Economy
536

A. M. Byers Company, Pittsburgh, Pa., has available a booklet on facts you should know to achieve **True Piping Economy.**

The booklet points out that when figuring piping economies there are three different basic costs to be considered: 1. Cost of pipe; 2. cost

DeZURIK . . . .

The NON-LUBRICATED

PLUG VALVE

for SEWAGE PLANTS

DeZURIK EASY-OPERATING VALVES are installed on a number of lines in the Bellevue, Washington, Sewage Plant (Carey & Kramer, Engineers).

They're operating on sludge lines from the primary settling tanks to the digester, on sludge and effluent lines from the digester.

DeZurik Plug Valves, with *exclusive* eccentric action, are the logical choice where dead-tight shutoff is required—especially on lines carrying solids in suspension. They need only an easy quarter-turn of the lever to open wide or shut tight. They need NO LUBRICATION, only an absolute minimum of maintenance.

Before you specify new or replacement valves, get the complete story on DeZurik Valves.

Write for details; representatives in principal cities.

DeZURIK

SHOWER COMPANY

SARTELL, MINN.

of installation; and 3. cost of maintenance. The cost of maintenance section demonstrates that if the pipe fails, the cost of the pipe and the cost of installation must be paid all over again.

Installation and maintenance costs are discussed in detail and emphasized by drawings. It also compares the cost of wrought iron pipe with other kinds of pipe.

Several case histories of wrought iron piping installations are given and a list of various services wherein wrought iron pipe has provided true piping economy are included. A short discussion on the qualities of wrought iron pipe and the facilities of the Byers engineering service department complete the booklet.

Sump Pumps

537

Aurora Pump Division of The New York Air Brake Company, Aurora, Illinois, has just released a new 3-color bulletin describing **Aurora Packaged Type DSA Sump Pumps.**

The new bulletin, which describes DSA sump pumps with capacities up to 170 gpm, and heads up to 70 ft, includes cutaway drawings, performance curves, proposed specifications and typical dimensions.

Diesel Standby Power

538

The Murphy Diesel Company, Milwaukee, Wisconsin, has just published a bulletin which illustrates emergency standby power applications of **Murphy Diesel Generator Sets,** diesel and dual-fuel engines.

The bulletin supplies information on design features and output data. Illustrations and cut-away drawings show construction and installation details.

Multiple V-Belt Drives

539

Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin, has just published a 36-page pocket size booklet that discusses the origin, history and development of the **Modern Multiple V-Belt Drive.**

The booklet also covers the evolution of standards in engineering V-belt drives, tells how to engineer a V-belt drive, provides tables and data, and describes modifications in V-belt drives.

(*Continued on page* 140*A*)

control seepage due to joint-separation or joint-movement!

Now — by the makers of Labyrinth Waterstops — a new CELLULAR WATERSTOP! Designed with three concrete gripping ribs plus a triple-cell structure, CELLULAR WATERSTOPS permit one side of the joint to move up, down and sideways in relation to the other side . . . keeps joints watertight in spite of separation or differential movement. And, what's more, the joint-protection of vinyl plastic CELLULAR WATERSTOPS far outlives that of any other waterstop. That's because CELLULAR WATERSTOPS last as long as the concrete itself; rust, rot, acids, alkalies, chemicals and atmospheric conditions *can't* hurt it. CELLULAR WATERSTOPS can also be used in conjunction with preformed expansion-joint fillers.

Find out more about this and other job-proven vinyl plastic waterstops made by Water Seals, Inc. Send coupon below.

Made by the makers of LABYRINTH WATERSTOPS . . . the standard waterseal on outstanding construction jobs everywhere — eliminates seepage problems . . . simplifies form work.

Made in Canada for J. E. Goodman Sales Ltd., Toronto, Ont.

WATER SEALS, INC.

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HOUSTON: Blackstone 6388
MOBILE: Hemlock 2-4466
NEW ORLEANS: Raymond 9744
SAN FRANCISCO: Yukon 6-2803
SEATTLE: Main 8930

Final chapter of the booklet furnishes the answers to a number of questions relating to some of the basic principles and practices involved in the engineering and use of multiple V-belt drives.

A-C Product Literature Directory

540

Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin, has just released a new 9 by 4 in., 24-page directory of product literature entitled **"This Is A-C From A to Z."**

In addition to an alphabetical description of company products and their descriptive literature, the directory has a brief history of Allis-Chalmers as an introduction. It also lists the location of the firm's 17 plants, sales offices and tractor branch houses.

A self-addressed, postage-prepaid post card attached to the inside of the back cover makes it easy to order any desired product literature.

Motor Control Center

541

General Electric Co., Distribution Assemblies Department, Plainville, Conn., has just released a bulletin describing a compactly designed general-purpose **Motor Control Center** which permits savings of up to 50 per cent in floor area.

The new publication describes in detail the construction and application of this GE motor control center. It also lists ratings, weights, dimensions, installation data, and guide form specifications.

Field Studies Of Corrosion Proofing

542

Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., has just published a new brochure on **Corrosion Proofing** materials and techniques that contains detailed information on cement mortars, interliners for masonry construction and protective coatings and linings for surface treatment.

The 8-page illustrated booklet contains sections describing the various Pennsalt materials for corrosion proof masonry construction and techniques for application based on studies of thousands of corrosion-proof masonry installations laid up in Pennsalt cement mortars over periods of 10 to 20 years. Installations surveyed include linings in acid concentrators,

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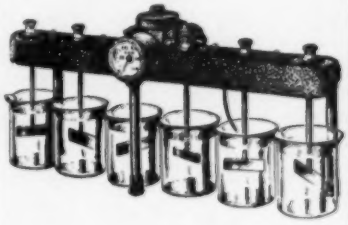

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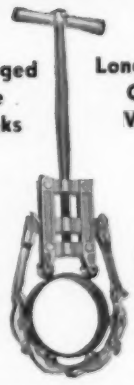
HEAVY-DUTY
ELLIS PIPE CUTTER
FOR CUTTING LARGE SIZE PIPE



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Long-Lasting Cutter Wheels

Makes a Hit With Water Works Men

Cuts Pipe in or Out of Ditch

TWO SIZES
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No. 1 for 4" to 12" Pipe

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ELLIS & FORD MFG. CO.
FERNDALE 20, MICH.

stacks, pickling tanks, brick and tile floors for the food processing and chemical industries, as well as sumps, pits and trenches for handling industrial wastes. Tables and charts are provided for selecting proper cement mortars and determining resistance to various corrosive conditions.

Pressure Controller

543

Minneapolis-Honeywell Regulator Company, Industrial Division, Philadelphia, Pa., has just published a bulletin on the new Honeywell small-case **Indicating Pressure Controller.**

The bulletin describes the controller as being available in ranges from 0-50 to 0-200 psi, with on-off or 10 per cent throttlor control. The case matches that of the small-case temperature controller.

Differential Converter Flow Transmitter

544

Minneapolis-Honeywell Regulator Company, Industrial Division, Philadelphia, Pa., has just released a specification sheet describing the **Differential Converter** mercuryless and liquid level transmitter, with non-bleed pilot relay.

According to the specification sheet, the converter operates on the pneumatic-balance principle, and transmits readings to receiving instruments at distances as great as 1000 ft from the point of measuring.

Color Movie On Zinc Corrosion Control

545

The American Zinc Institute, Inc., New York, N. Y., has just produced a new 16 mm. sound and color motion picture entitled **"Zinc Controls Corrosion."**

Available for showing before agricultural, industrial, technical, and

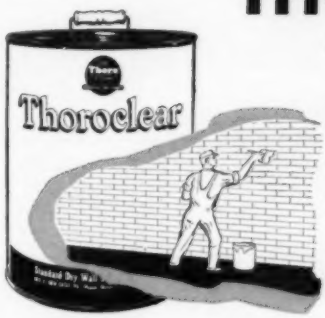
(*Continued on page* 142*A*)

HELP WANTED

MECHANICAL ENGINEER—Recent M. E. graduate desired for employment as project engineer in long established valve manufacturing firm. Permanent position. Excellent opportunity for advancement. Salary commensurate with ability. Located in progressive North Central Penna. community. Experience in Pressure Vessels and Piping desirable but not necessary. Submit qualifications to Box 1138, Water & Sewage Works, 185 N. Wabash Ave., Chicago 1, Illinois.

The THORO System
of Masonry Protection

THOROCLEAR



Invisible Water Repellent

Ask your dealer about this powerful silicone water repellent developed by years of research by General Electric Company and now produced by us for your protection. *Ask for Circulars No. 30 and 31.*

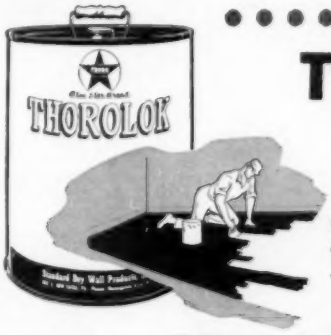
No change in color or texture of brick, limestone, sandstone, tile or stucco surfaces. Applied by brush or spray.

Keep water out of your masonry walls and protect interior plaster, paints and expensive furnishings.

THORITE

20 Minute Set Patching Compound

Repair those broken sills, steps, concrete floors, chimneys and other defective masonry! *Ask for circular No. 20.*



THOROLOK
NO. 100

Use it for your basement or factory floors. New, with special alkali resistant pigments. *Ask for Color Card 32-C.*

Manufacturers of

WATERPLUG, THOROSEAL, QUICKSEAL

for all types of masonry protection!

GET OUR PICTORIALLY DESCRIBED LITERATURE "HOW TO DO IT"

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNSYLVANIA

educational groups, the new AZI film dramatically tells how zinc in its role of "protector" controls corrosion to lengthen life, and to minimize maintenance and replacement costs.

The new film, which has a running time of about 35 min, presents a colorful demonstration of the general mechanism of corrosion as well as how zinc controls it. It gives pictorial evidence that a sound corrosion-prevention program based on the use of zinc will lengthen the life of steel products, markedly reduce maintenance costs, and increase net earnings.

Through lavish use of animation and color, "Zinc Controls Corrosion" shows how zinc functions to control the corrosion of iron and steel by acting as a barrier and by affording galvanic protection. It then explains methods for coating steel stock or products with zinc, and surveys the various fields of usefulness for zinc-coated parts.

Pitot Water Leak Detector

546

Simplex Valve & Meter Co., Lancaster, Pa., has just published a 20-page bulletin on **Simplex Pitot Equipment.** Comprehensive and well documented, the bulletin will be of interest to engineers and maintenance personnel of municipalities, public works and water works dealing with water conservation and water wastage.

Describing the Simplex Pitot Assembly, consisting of a pitot rod, manometer, and pitot recorder, this equipment is used to locate hidden leaks in water mains which waste thousands of gal per day. Valuable data on care of equipment, installation instructions, theory of operation and formulae is contained that will help to reduce "unaccounted-for-water" to a minimum.

Manometer Bulletin

547

The Meriam Instrument Company, Cleveland, Ohio, has just published a convenient, quick-reference guide on **Meriam Manometers.**

The bulletin sets forth the four basic types of manometers ranging from the simple U-tube to the ultra-precision models and provides principles to aid in the proper selection. Specialized manometer instruments are also described for pressure, vacuum, flow and liquid level services as well as electrical contactor-type manometers and portable manometer kits for field instrument calibration. Range, working pressure, application and a brief description are given for each instrument.

Shock And Vibration Control For Water Lines

548

T. R. Finn & Company, Inc., Industrial Division, Hawthorne, N. J., has just issued a catalog describing the **Soundzorber,** a wire-reinforced rubber pipe for eliminating noise and vibration from water lines.

The catalog gives detailed descriptions of their construction. These include the smooth inner lining of high-tension abrasion-resisting rubber, the pipe walls of rubber impregnated wire-reinforced fabric imbedded in rubber for their full length, and outer wall coverings of abrasion, sun and weather-resisting rubber. Small pipes are equipped with male iron pipe thread fittings. Large sizes have integral full-faced rubber flanges backed with either 150- or 300-lb drilling steel flanges also imbedded in rubber. Illustrations

It's True There are Other "Good" PIPE DETECTORS

and EACH ONE WILL PERFORM ALL THESE JOBS:
- Detect, trace and center pipes, cables, etc.
- Estimate their depth
- Separate parallel pipes, cables, etc.

Model 505 Pipe Detector

But... Do They Have ALL These "505" Features

1. ALUMINUM CASE shields the loops from outside interference and is light — durable — repairable.
2. BUILT-IN BATTERY TESTERS plus 67½ V batteries insure maximum service, more efficiency, more power.
3. QUICK-ACTION ALUMINUM HANDLE set up in seconds for one man operation.
4. LIFETIME GUARANTEE assuring reliable performance for the entire life of instrument.

Also Available: Model 505-C Combination Pipe-Leak Detector

Get the complete "505" story — write Dept. 57

Detectron The DETECTRON Corp.
5528 Vineland, North Hollywood, Calif.

Nu-Rail SLIP-ON FITTINGS
AN ENTIRELY NEW METHOD OF FITTING PIPE

Make Railings Better, Faster and For Less!

There's almost a mile of railing at the City Garbage Disposal Plant in Dallas, Texas. Galvanized pipe and Nu-Rail Fittings were used to great advantage. The long runs of pipe rail effected big savings because with Nu-Rail pipe passes pipe and reduces the need for cutting. Nu-Rail Fittings are available in a wide and complete range of I.P.S. from ¾ x ¾" to 2 x 2", including reducing sizes from 1 x ¾" to 2 x 1½". Make all your railings with Nu-Rail. No welding, no threading. Write for details. The Hollaender Mfg. Co., 3834 Spring Grove Ave., Cincinnati 23, Ohio.

of typical installations, noise, vibration and water hammer control, dimensions and comparisons of acoustical impedance are also described.

Iron Removal Article

549

Graver Water Conditioning Co., New York, N. Y., has available a new, comprehensive article on **Iron and Manganese Removal From Water Supplies.** This paper discusses this troublesome problem being encountered more and more each day by industry and municipalities alike.

This article presents details and actual engineering layouts of seven different types of iron removal systems. Since iron can be found in many different forms in a water supply, there is no one solution. As pointed out in this paper, each case must be individually considered. The seven methods discussed can handle any type of problem encountered.

Several actual case histories are discussed, the problems analyzed and the results presented. Flow sheets of these plants are also included.

High-Capacity Chlorine Gas Feeder

550

Builders-Providence, Inc., Providence, R. I., has just released a colorful, 4-page bulletin describing their **High-Capacity Volumetric Gas Feeder** which accurately controls and meters chlorine gas under vacuum to produce and deliver chlorine-water solution to the point of application at rates up to 8,000 lbs per 24 hr maximum—with a standard meter range of 1 to 10.

This Chlorinizer, is fully described in informative sections devoted to operation, safety features, and control variations. The bulletin text is augmented by suitable illustrations and flow diagrams.

Centrifugal Pumps

551

The Deming Company, Salem, Ohio, has just published a bulletin describing the company's complete line of redesigned and resized **End Suction Centrifugal Pumps.**

Illustrations show the different pumps and power ends, to which numerous sizes of liquid ends can

(*Continued on page* 144*A*)

BIG valve... little space

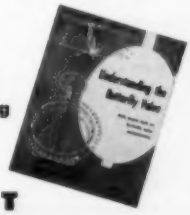
The disc in this 84-in. low pressure Butterfly Valve must withstand 138,000 lbs. of force when closed against a 25 P.S.I. line pressure . . . yet the face to face dimension is only 18 in. and the entire valve weighs just 12,000 lbs. Even under this severe loading Pratt design keeps the bearing pressure well below 2500 P.S.I.

Pratt Rubber Seat Butterfly Valves are manufactured in sizes from 10 in. to 168 in. in diameter, in pressure ratings up to 125 P.S.I. Their low initial cost, easy installation and proven low maintenance make them the logical solution to valving problems, both for new projects and as replacements.

The Henry Pratt Company originated and has been making this type of valve for over 28 years. Our background represents the greatest cumulative experience in the industry. It is the reason why Pratt Valves are so convenient to install, easy to operate and give long years of trouble-free service. **For full details write for Bulletin 1-C.**

HENRY PRATT

Send for informative booklet "Understanding Butterfly Valves."



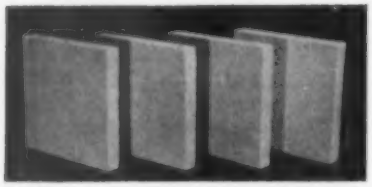
RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

FILTROS

brings Substantial SAVINGS and Increased EFFICIENCY to Water Filtration



Modern porous plate underdrain systems of FILTROS silica and fused alumina offer new efficiency in water filtration — PLUS installation and maintenance savings. Consider these advantages:

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3. Prevents formation of mud balls.
4. Porous plates resist corrosion.
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We will gladly show you how FILTROS can modernize and simplify your filtration system at moderate cost. Write today for complete information.

FILTROS Porous Plates and Tubes for Air Diffusion in Sewage Treatment Plants also have outstanding advantages. Ask for information.

FILTROS INC.

802 W. Commercial St., East Rochester, New York

Pioneer Manufacturers of Porous Ceramics Since 1913

be attached. Performance tables and curves in the bulletin list characteristics of all possible combinations.

According to the bulletin separate alloy liquid end construction is available on most sizes for handling liquids that are abrasive or corrosive, and liquids carrying lime, chips and other solids that cause unusual pump wear.

Metering Pump Accuracy Tests
552

Milton Roy Company, Philadelphia, Pa., has available the text and illustrations of a recent talk given before the Instrument Society of America on factors governing accuracy in **Controlled Volume Pumping.** Test procedures and results of how separate investigations into metering accuracy are recorded.

The paper describes how controlled volume pumps, because of their high volumetric efficiency and accuracy, are used as flow control instruments in both open and closed loop instrumentation systems. Typical systems are illustrated, including those showing the use of controlled volume pumps as flow controllers, ratio controllers and final control elements.

Tractor Mounted Trencher
553

The Earth Equipment Corp., Los Angeles, Calif., has just issued a newly revised brochure describing the **Model 60 Everett Trencher.**

The black and orange 4-page leaflet has a large photograph on the cover, showing the trencher in action. The inside spread covers its numerous features including generous ground clearance, right-or-left-hand dirt delivery, the up-and-down lifting system, independent hydraulic system, ability to operate within a barrier 36 in. from the center line of the trench and several unique dumping features.

The leaflet portrays photographically the operation of the hydraulic drive on the conveyor, belt slip clutch, independent hydraulic system and bucket line. Complete specifications are also included.

Verticlosed Pump Motors
554

U. S. Electrical Motors Inc., Los Angeles, Calif., has just released a brochure embodying 66 full-colored illustrations and technical drawings depicting features and

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EVERYTHING FOR THE SWIMMING POOL
1955
30 YEAR ANNIVERSARY-
30 years experience built into this simple fool-proof indestructable vacuum design chlorinator 300 to 1000 lb. capacity
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Freedom from ttl repair costs makes Type M series outstanding in its field 50 to 300 lb. capacity Vacuum design
No springs or diaphrams or small delicate parts to corrode, eat up or quickly wear out 5 to 50 lb. capacity Vacuum design
Type M-3
Chemco chlorinators 25 years old are still in service. Can't beat 'em. All models can be purchased semi-automatic vacuum design 0 to 15 lb. capacity
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When you buy a well screen, the more open space you get, the more efficient will be your screen—because water doesn't flow through blank metal. Examine the exclusive welded design of the Johnson Well Screen, and you'll agree that you are getting the greatest amount of intake opening while retaining adequate strength. And you can't beat a Johnson Screen for maximum well development. *Write for literature.*

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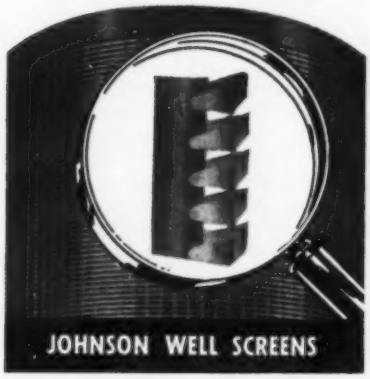
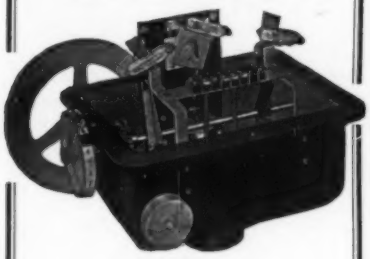


ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
783 Hampden Ave., St. Paul 4, Minn.

applications of various types of **Vertical Turbine Pump Motors.**

The brochure describes hollow shaft Verticlosed grease- and oil-lubricated motors in sizes from 1½ to 400 hp; also single phase designs up to 7½ hp, and totally-enclosed types up to 150 hp.

Various arrangements of bearing settings are presented; also an improved design of backstop to prevent backspin of the pump shaft when the pump is shut off and water recedes. Graphs showing relation of thrust bearing life to contact angle, and starting characteristics of part-winding increment start motors are of especial interest to pump engineers.

Transite Pressure Pipe Installation Guide

555

Johns-Manville, New York, N. Y., has just published a new 108-page instruction manual entitled **"Transite Ring-Tite Pressure Pipe Installation Guide."**

Planned for on-the-job use at the trench site, the manual is a handy 4¼ x 8 in. in size and has rounded corners so it slips in and out of pockets easily. Also it has a durable cover to assure long outdoor service in the field.

The instructions take up every step from receiving the pipe at the job to testing the finished installations. It also has information on special situations such as bridge crossings. There are nearly a hundred illustrations. At the back of the guide is a comprehensive index to subjects.

Sub-Surface Washer For Demineralizers, Softeners and Filters

556

Graver Water Conditioning Co., New York, N. Y., has available a Technical Reprint on the **Sub-Surface Washer.** This paper discusses the development of the washer that is used in demineralizers, Zeolite softeners and filters.

According to the reprint, the bed fouling of filters and ion exchange units is mostly caused by dense or sticky precipitates or fibrous material. The paper presents the causes of fouling and the problems encountered with actual installations in a variety of industries. The steps leading to the development of the Sub-Surface Washer are presented and a cut-away drawing

(*Continued on page 146A*)

TAYLOR COMPARATORS
help you control

CHLORINATION
pH
FLUORIDATION
ALGAE
FOAMING

with fast, easy
COLORIMETRIC *analyses*

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showing this unit is included. Other descriptive material includes flow sheets and a diagrammatic sketch of pilot unit observations.

Water Treatment

557

Infilco Inc., Tucson, Arizona, has just published a bulletin that explains in detail the advantages of **Wagner Filter Underdrains** in providing every requirement for perfect wash water distribution which assures proper and efficient filter backwash.

This 8-page bulletin has typical drawings showing how these underdrains are easily incorporated in designs of filter beds of practically all sizes and arrangements. Performance data also included show remarkable failureless 15-year record of operation in many domestic and foreign installations.

Sewage Treatment

558

Infilco Inc., Tucson, Arizona, has just published a bulletin that explains design and performance of **"Accelo Hi-Cap"** filter underdrain tile used extensively with high-rate trickling filters.

The bulletin shows that each block contains two ducts large enough to handle maximum requirements of both drainage and ventilation. Blocks are made of vitrified, salt-glazed fire clay for permanency. Performance data show they do not crack or break under load of filter media—do not clog or deteriorate under the action of sewage. Uniform air distribution to all filter parts is also accomplished.

Electronic Potentiometer And Bridge Instruments

559

The Bristol Company, Waterbury, Conn., has just published a bulletin covering **Cynamaster Electronic Potentiometer and Bridge Instruments** for recording and controlling.

The 64-page, 2-color bulletin is divided into three main sections. The first section gives details of the instrument and its components, as well as the principles of operation. The second section lists sensing elements and special attachments. The third section describes and illustrates other manufacturer's equipment in which Dynamasters have been incorporated.

Also listed in the bulletin are full specifications for the various models of recorders, and automatic controllers available.

A.W.W.A. Valves

560

The Kennedy Valve Mfg. Co., Elmira, New York, has issued a new bulletin on its complete line of **A. W. W. A. Valves** with complete description and detailed cross section and cutaway views describing construction and operation.

The new Bulletin also includes detailed information on O-Ring construction and lists in detail complete range of sizes.

While A. W. W. A. Specifications cover only bell end and flanged end non-rising stem gate valves in size range of 3" through 48", the Kennedy Bulletin also includes Outside-Screw-and-Yoke Gate Valves conforming to these specifications, applicable to design, construction, working pressures, hydrostatic tests and inspection requirements.

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Adds Secondary Treatment to Sewage Plant . . . Biofiltration Flowsheet Used

El Paso, rapidly growing Texas city, recently added secondary treatment to its sewage plant employing four Dorrco Distributors followed by two Monorake mechanisms.

The two Monorake units are each installed in a basin 67 ft. 10½" wide by 245 ft. long. The Distributors, among the largest ever manufactured, are 220 ft. in diameter each capable of handling a maximum flow of 13,900 gpm at 2.75 ft. head.

If you would like more information on the complete line of Dorr-Oliver sewage treatment equipment write to Dorr-Oliver Incorporated, Stamford, Connecticut for Bulletin No. 6041.

Monorake T.M. Reg. U. S. Patent Office

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INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
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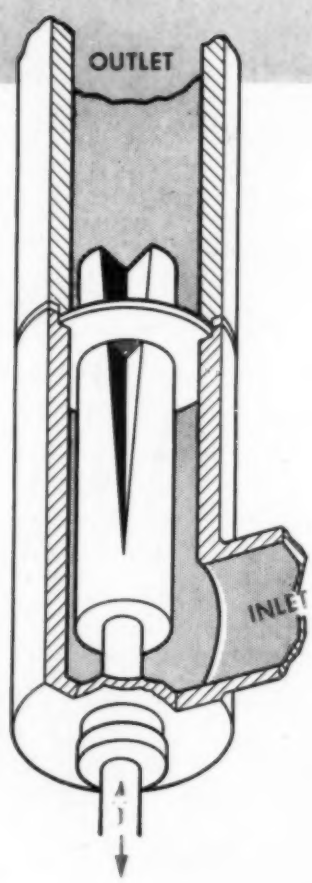
THE WALLACE & TIERNAN

V-NOTCH

variable-orifice

. . . a new concept for chlorinator control



The W&T V-notch Variable-Orifice is the heart of a new chlorinator control system. With the system, a constant differential vacuum is maintained across the V-notch Variable-Orifice and the flow of chlorine gas is adjusted by varying the area of the orifice.

The W&T V-notch Variable-Orifice has these features:

- Wide range adjustment of chlorine flow
- Excellent reproducibility of flow by a simple adjustment
- Same % accuracy over entire wide flow range

As can be seen in the diagram, the V-notch Variable-Orifice is formed by a cylindrical plug positioned inside a matched, circular ring. A V-shaped groove is machined along the length of the plug. The groove starts near one end of the plug and gradually enlarges to its maximum width and depth at the other end of the plug. The V-notch Orifice is formed at the intersection of the grooved plug and the matched ring. The orifice area is varied simply and positively by positioning the plug backward or forward inside the fixed ring.

The V-notch Variable-Orifice is just one design feature of the new W&T V-notch line of chlorinators. Get all the facts about the W&T V-notch chlorinators before you buy chlorination equipment.

See W&T V-notch Chlorinators at the AWWA Convention, St. Louis, May 6-11.

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